ALBERT R. MANN
LIBRARY

AT

CORNELL UNIVERSITY

CORNELL UNIVERSITY LIBRARY

3 1924 068 452 683

DATE DUE

GAYLORD			PRINTED IN U.S.A.

600
M992
V. 46
1993

MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

Vol. XLVI January-March 1993

CONTENTS

Identification of Orcinol Para-Depsides in the lichen genus *Pertusaria* by thin layer chromatography . . . . . **Alan W. Archer** 1
Occurrence of *Gloeophyllum sepiarium* (Wulf.:Fr.) Karst. in India. **Anjali Roy and R. Bhattacharya** 5
Concerning the generic limits in *Haplographium* . . **Laura Zucconi and Sabina Pagano** 11
Additions to *Mycosphaerella* in the fynbos biome. **P. W. Crous and M. J. Wingfield** 19
Two new species of *Inocybe* from Japan. **Takahito Kobayashi and Regis Courtecuisse** 27
Ramularia biscutellae sp. nov. . . . . **Simeon G. Vanev** 35
Hyphoderma etruriae sp. nov. (Corticiaceae, Basidiomycetes) from the natural reserve of Burano, Italy. . . . . **Annarosa Bernicchia** 37
Discosia arxii sp. nov. . . . . **Simeon G. Vanev** 41
Redisposition of some taxa described by J. B. Ellis. . . . . **Margaret E. Barr** 45
Calvatia pachyderma (Peck) Morg. and *Gastropila fragilis* (Lév.) Homrich et Wright, two possible names for the same fungus. . . . . **V. Demoulin** 77
Unusual spore print colouration within the family Hygrophoraceae: Two distinctive taxa recorded from Tasmania . . . . . **Alan Mills and Angela Monks** 85
A revision of *Bulbouncinula bulbosa*: A new powdery mildew record from Taiwan, and its presumed anamorph . . . . . **Ker-chung Kuo** 93
Mycena gaultheri rediscovered after 50 years. **Scott A. Redhead and Lorelei L. Norvell** 97
New reports of Parmeliaceae *s. str.* (Lichenized Ascomycotina) from Southwestern Argentina . . . . . **Mónica Adler and Susana Calvelo** 105
Talaromyces indigoticus, a new species from soil. **Masaki Takada and Shun-ichi Udagawa** 129
Lichenes Canadenses Exsiccati: Fascicle IV. . . . **Irwin M. Brodo and Pak Yau Wong** 135
A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features . . . . . **Brenda E. Callan and Jack D. Rogers** 141

[Contents continued overleaf]

ISSN 0093-4666 MYXNAE 46:1-508 (1993)

Published quarterly by MYCOTAXON, LTD., P. O. Box 264, Ithaca, NY 14851.
For subscription details, availability in microfilm and microfiche, and availability of articles as tear sheets, see back cover.

[Contents continued from front cover]

A new bluing *Psilocybe* from Thailand.
Gastón Guzmán, Victor M. Bandala and John W. Allen 155
Further observations on the genus *Psilocybe* from New Zealand.
Gastón Guzmán, Victor M. Bandala and Chris C. King 161
Alternaria themes and variations (54-62). . . . . **Emory G. Simmons** 171
Meliolaceae of Southern India - XII.
V. B. Hosagoudar, R. Rajeshwari Dayal and R. D. Goos 201
Umbilicaria dendrophora. . . . . **Geir Hestermark** 211
Additions to *Calonectria*. . . . . **P. W. Crous, M. J. Wingfield and A. C. Alfenas** 217
New Hyphomycetes from Santiago River VI. (Buenos Aires Province, Argentina).
M. C. Cazau, A. M. Arambarri and M. N. Cabello 235
Neocallimastix variabilis, a new species of anaerobic fungus from the rumen of cattle.
Y. W. Ho, D. J. S. Barr, N. Abdullah, S. Jalaludin and H. Kudo 241
Endoconospora indica spec. nov . . . . . **U. Braun and V. B. Hosagoudar** 259
Phytoparasitic hyphomycetes from Utah (USA). . . . . **U. Braun and C. T. Rogerson** 263
Two new coprophilous Pezizales from the Sultanate of Oman.
J. Gené, A. E. ElShafie and J. Guarro 275
Minimidochium indicum, a nomenclatural correction. . . . **B. P. R. Vittal and M. Dorai** 285
Mortierella paraensis n. sp. from Brazilian soil. . **Ludwig Pfenning and Walter Gams** 287
New hyphomycete species from litter in the Chatham Islands, New Zealand.
E. H. C. McKenzie 291
Crassoascus, a new nonstromatic genus in the Clypeosphaeriaceae.
J. M. Barrasa, J. Checa and A. T. Martínez 299
A new species of *Spiromastix* from Africa. . . . **J. Guarro, J. Gené and C. De Vroey** 307
A new species of *Comatricha* with incompletely reticulated spores from Spain.
A. Castilla, G. Moreno and C. Illana 315
Phlebia pallida in North America. . . . . **J. Ginns** 321
Identity and taxonomy of hitherto unreported pathogen causing leaf spot disease
of ginger in India. . . . . **M. K. Rai** 329
Myrothecium groenlandicum sp. nov., a presumed endophytic fungus of
Betula nana (Greenland). . . . . **Michael Bohn** 335
Phaeocollybia inWestern Canada. . . . . **Scott A. Redhead and Lorelei L. Norvell** 343
Alternaria triglochinicola sp. nov. . . . . **J. L. Alcorn and S. M. Francis** 359
Conidium development in the *Knoxdaviesia* of *Ceratocystiopsis proteae*.
Marnel Mouton, Michael J. Wingfield, P. Schalk Van Wyk 363
Conidium development in the synnematous anamorphs of *Ophiostoma*.
Marnel Mouton, Michael J. Wingfield, P. Schalk Van Wyk 371
Ophiostoma bragantinum n. sp., a possible teleomorph of *Sporothrix inflata* found
in Brazil. . . . . **Ludwig Pfenning and Franz Oberwinkler** 381
Some pyrenomycetes on three ericaceous hosts in Western North America.
Margaret E. Barr 387
Cookeina sulcipes - an addendum. . . . . **Richard T. Hanlin** 403

[Continued inside back cover]

MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

VOLUME XLVI, 1993

ALBERT R. MANN
LIBRARY
FEB 19 1993
ITHACA, NY 14853

COMPLETE IN ONE VOLUME

CONSISTING OF iv + 508 PAGES INCLUDING FIGURES

QK
600
M992
V.46
1993

EDITOR-IN-CHIEF

JEAN BOISE CARGILL
Harvard University Herbaria
22 Divinity Avenue, Cambridge, MA 02138, USA

ASSOCIATE EDITORS

LINDA M. KOHN
Book Review Editor
Botany Department, University of Toronto – Erindale
Mississauga, Ontario L5L 1C6, Canada

GRÉGOIRE L. HENNEBERT
French Language Editor
Laboratoire de Mycologie systématique et appliquée
Université Catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium

ROBERT DIRIG
Index Editor
Bailey Hortorium, Mann Library Building
Cornell University, Ithaca, NY 14853, USA

EDITORIAL ADVISORY BOARD

OVE E. ERIKSSON, Umeå, Sweden (1990-93)
GRÉGOIRE L. HENNEBERT, Louvain-la-Neuve, Belgium (1990-96)
JAMES W. KIMBROUGH, Gainesville, Florida (1992-97)
RONALD H. PETERSEN, Knoxville, Tennessee (1990-94)
JACK D. ROGERS, Pullman, Washington (1990-92, *Chm.*)
AMY Y. ROSSMAN, Beltsville, Maryland (1990-95)

Published by

MYCOTAXON, LTD., P.O. BOX 264
ITHACA, NY 14851-0264, USA

Printed in the United States of America

Table of Contents, Volume Forty-six
January-March 1993

Identification of Orcinol Para-Depsides in the lichen genus *Pertusaria* by thin layer chromatography. . . . . **Alan W. Archer** 1

Occurrence of *Gloeophyllum sepiarium* (Wulf.:Fr.) Karst. in India. **Anjali Roy and R. Bhattacharya** 5

Concerning the generic limits in *Haplographium* . . **Laura Zucconi and Sabina Pagano** 11

Additions to *Mycosphaerella* in the fynbos biome. **P. W. Crous and M. J. Wingfield** 19

Two new species of *Inocybe* from Japan. **Takahito Kobayashi and Regis Courtecuisse** 27

Ramularia biscutellae sp. nov. . . . . **Simeon G. Vanev** 35

Hyphoderma etruriae sp. nov. (Corticiaceae, Basidiomycetes) from the natural reserve of Burano, Italy. . . . . **Annarosa Bernicchia** 37

Discosia arxii sp. nov. . . . . **Simeon G. Vanev** 41

Redisposition of some taxa described by J. B. Ellis. . . . . **Margaret E. Barr** 45

Calvatia pachyderma (Peck) Morg. and *Gastropila fragilis* (Lév.) Homrich et Wright, two possible names for the same fungus. . . . . **V. Demoulin** 77

Unusual spore print colouration within the family Hygrophoraceae: Two distinctive taxa recorded from Tasmania . . . . . **Alan Mills and Angela Monks** 85

A revision of *Bulbouncinula bulbosa*: A new powdery mildew record from Taiwan, and its presumed anamorph. . . . . **Ker-chung Kuo** 93

Mycena gaultheri rediscovered after 50 years. **Scott A. Redhead and Lorelei L. Norvell** 97

New reports of Parmeliaceae *s. str.* (Lichenized Ascomycotina) from Southwestern Argentina . . . . . **Mónica Adler and Susana Calvelo** 105

Talaromyces indigoticus, a new species from soil. **Masaki Takada and Shun-ichi Udagawa** 129

Lichenes Canadenses Exsiccati: Fascicle IV. . . . **Irwin M. Brodo and Pak Yau Wong** 135

A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features. . . . . **Brenda E. Callan and Jack D. Rogers** 141

A new bluing *Psilocybe* from Thailand. **Gastón Guzmán, Victor M. Bandala and John W. Allen** 155

Further observations on the genus *Psilocybe* from New Zealand. **Gastón Guzmán, Victor M. Bandala and Chris C. King** 161

Alternaria themes and variations (54-62). . . . . **Emory G. Simmons** 171

Meliolaceae of Southern India - XII. **V. B. Hosagoudar, R. Rajeshwari Dayal and R. D. Goos** 201

Umbilicaria dendrophora. . . . . **Geir Hestermark** 211

Additions to *Calonectria*. . . . . **P. W. Crous, M. J. Wingfield and A. C. Alfenas** 217

New Hyphomycetes from Santiago River VI. (Buenos Aires Province, Argentina). **M. C. Cazau, A. M. Arambarri and M. N. Cabello** 235

Neocallimastix variabilis, a new species of anaerobic fungus from the rumen of cattle. **Y. W. Ho, D. J. S. Barr, N. Abdullah, S. Jalaludin and H. Kudo** 241

Endoconospora indica spec. nov . . . . . **U. Braun and V. B. Hosagoudar** 259

Phytoparasitic hyphomycetes from Utah (USA). . . . . **U. Braun and C. T. Rogerson** 263

Two new coprophilous Pezizales from the Sultanate of Oman.
J. Gené, A. E. ElShafie and J. Guarro 27
Minimidochium indicum, a nomenclatural correction. . . . **B. P. R. Vittal and M. Dorai** 28
Mortierella paraensis n. sp. from Brazilian soil. . **Ludwig Pfenning and Walter Gams** 28
New hyphomycete species from litter in the Chatham Islands, New Zealand.
E. H. C. McKenzie 29
Crassoascus, a new nonstromatic genus in the Clypeosphaeriaceae.
J. M. Barrasa, J. Checa and A. T. Martínez 29
A new species of *Spiromastix* from Africa. . . . **J. Guarro, J. Gené and C. De Vroey** 30
A new species of *Comatricha* with incompletely reticulated spores from Spain.
A. Castilla, G. Moreno and C. Illana 31
Phlebia pallida in North America. . . . . **J. Ginns** 32
Identity and taxonomy of hitherto unreported pathogen causing leaf spot disease of ginger in India. . . . . **M. K. Rai** 32
Myrothecium groenlandicum sp. nov., a presumed endophytic fungus of *Betula nana* (Greenland). . . . . **Michael Bohn** 33
Phaeocollybia inWestern Canada. . . . . **Scott A. Redhead and Lorelei L. Norvell** 34
Alternaria triglochinicola sp. nov. . . . . **J. L. Alcorn and S. M. Francis** 35
Conidium development in the *Knoxdaviesia* of *Ceratocystiopsis proteae*.
Marnel Mouton, Michael J. Wingfield, P. Schalk Van Wyk 36
Conidium development in the synnematous anamorphs of *Ophiostoma*.
Marnel Mouton, Michael J. Wingfield, P. Schalk Van Wyk 37
Ophiostoma bragantinum n. sp., a possible teleomorph of *Sporothrix inflata* found in Brazil. . . . . **Ludwig Pfenning and Franz Oberwinkler** 38
Some pyrenomycetes on three ericaceous hosts in Western North America.
Margaret E. Barr 38
Cookeina sulcipes - an addendum. . . . . **Richard T. Hanlin** 40
Spanish Myxomycetes. VII. (Province of Castellon).
G. Moreno, C. Illana and A. Burguete 40
Vulpicida, a new genus in Parmeliaceae (Lichenized Ascomycetes).
Jan-Eric Mattsson and Ming-Jou Lai 42
The value of dried fungal cultures for taxonomic comparisons using PCR and PFLP analysis. . . . . **B. D. Wingfield and M. J. Wingfield** 42
Water-borne hyphomycetes in Singapore, with a description of an undescribed species of *Trichocladium*. . . . . **Keisuke Tubaki, Teck Koon Tan and Yoshio Ogawa** 43
Morphology of edge lines of chained immature conidia on conidiophores in powdery mildew fungi and their taxonomic significance. . . . . **Hyeon Shin and Yong-joon La** 44
Lecanora navarrensis, a new lichen species from North Spain. . . . . **J. Etayo** 45
Revision of *Schizoparme* (Diaporthales, Melanconidaceae).
Gary J. Samuels, Margaret E. Barr and Rosalind Lowen 45
Book reviews. . . . . **L. M. Kohn** 48
Author INDEX 49
INDEX to fungous and lichen taxa. 49
Reviewers. 50
Errata. 50
Publication Date, MYCOTAXON Volume 45. 50

MYCOTAXON

Volume XLVI, pp. 1-4 January-March 1993

IDENTIFICATION OF ORCINOL PARA-DEPSIDES IN THE LICHEN GENUS PERTUSARIA BY THIN LAYER CHROMATOGRAPHY

ALAN W. ARCHER

National Herbarium of New South Wales,
Royal Botanic Gardens, Sydney, NSW, Australia, 2000

INTRODUCTION

Species in the lichen genus *Pertusaria* may contain a combination of, or a selection from, a xanthone, an orcinol depside or depsone, or a β-orcinol depsidone or depside. The orcinol depsides have either methyl substituents (C1 compounds) or substituents with propyl (C3), pentyl (C5) or longer side chains. These metabolites are useful for taxonomic purposes.

Lichen compounds may be separated and identified by a variety of techniques of which one of the simplest is thin layer chromatography and a standardised system of mobile phases for use with silica gel as a stationary phase has been published (Culberson 1972). Additional mobile phases have been developed for the improved separation of β-orcinol depsidones (Culberson et al.1981) and xanthones (Elix & Crook 1992). This note describes an alkaline mobile phase for the separation and identification of the taxonomically significant C3 and higher orcinol depsides present in *Pertusaria* species; the novel *meta*-depside, 4-*O*-methylisocryptochlorophaeic acid, which is present in the genus, is also included among the compounds studied. The structure of the orcinol depsides examined is shown in Table 2.

MATERIALS AND METHODS

Thin layer chromatography was carried out on 10 x 20 cm glass plates coated with silica gel 60 F_{254} (Merck) [previously stored over silica gel as desiccant] in an unlined glass tank with a mobile phase composed of: ethyl acetate 75 mls, methanol 20 mls and ammonia (SG 0.91, about 25% ammonia) 5 mls. The solvent front was allowed to rise *ca.* 110 mm above the starting line, which was 20 mm above the base of the plate. This usually required about 30 mins. The lichen compounds were synthesised in the Chemistry Department, Australian National University, Canberra. Similar Rf values were found if the glass plates were dried at 120°C for 30 minutes before use andthe methanol in the mobile phase was replaced with ethanol. After chromatography the plates were allowed to air dry and sprayed with either sulphuric acid (Culberson & Kristinsson 1970) or 3-methyl-2-benzothiazolone hydrazone hydrochloride, MBTH (Archer 1978) and the colours noted.

Extracts from the following *Pertusaria* species may be used as a source of the depside indicated:

P. paratuberculifera Dibben, *P. mattogrossensis* Malme: 2-*O*-methylperlatolic acid
P. leucoplaca Müll.Arg. [syn: *P. acuta* Müll.Arg.]: 2-*O*-methylstenosporic acid
P. globularis (Ach.) Tuck., *P. cerussata* Malme: 2'-*O*-methylperlatolic acid
P. subobductans Nyl., *P. hartmannii* Müll.Arg.: perlatolic acid

TABLE 1

Rf VALUES AND COLOUR REACTIONS OF *PERTUSARIA* DEPSIDES

Compound	Rf Values (x 100) in Mobile Phase: C	OH	Colour Reactions with: Sulphuric acid	MBTH
perlatolic acid	65	65	yellow	orange
2'-*O*-methylperlatolic acid	61	29	yellow	orange
2-*O*-methylperlatolic acid	52	63	yellow	red
stenosporic acid	52	58	orange	orange
2'-*O*-methylstenosporic acid	59	25	yellow	orange
2-*O*-methylstenosporic acid	48	59	yellow	orange-red
2,2'-di-*O*-methylstenosporic acid	45	24	yellow	nil*
planaic acid	50	33	yellow	nil*
anziaic acid	33	47	yellow	orange
miriquidic acid	44	65	brown-green	orange
confluentic acid	46	30	yellow	orange-red
2-*O*-methylconfluentic acid	44	29	yellow	nil*
2-*O*-methyldivaricatic acid	46	51	yellow	red
4-O-methylisocrypto-chlorophaeic acid	45	51	brown-grey	red-brown

Mobile phase C: toluene 85 mls, acetic acid 15 mls

Mobile phase OH: ethyl acetate 75 mls, methanol 20 mls, ammonia 5 mls

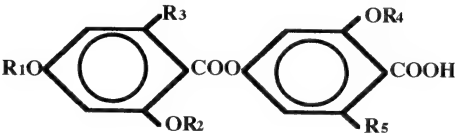
* no colour produced

RESULTS

The Rf values found in acidic and alkaline mobile phases are shown in Table 1 together with the colours produced with sulphuric acid and MBTH. A combination of Rf values in the two mobile phases and the colour reactions with the two reagents permits identification of the depsides. The other compounds that may be present in extracts from *Pertusaria* specimens do not interfere in the separation. The two most common xanthones, lichexanthone and 4,5-dichlorolichexanthone, have Rf values of ca. 0.95, while thiophaninic acid with Rf 0.52 (in mobile phase OH) is distinguished by its orange fluorescence.

TABLE 2

ORCINOL *p*-DEPSIDES PRESENT IN *PERTUSARIA* SPECIES



Name:	R_1	R_2	R_3	R_4	R_5
perlatolic acid	CH_3	H	C_5H_{11}	H	C_5H_{11}
2'-*O*-methylperlatolic acid	CH_3	H	C_5H_{11}	CH_3	C_5H_{11}
2-*O*-methylperlatolic acid	CH_3	CH_3	C_5H_{11}	H	C_5H_{11}
stenosporic acid	CH_3	H	C_3H_7	H	C_5H_{11}
2'-*O*-methylstenosporic acid	CH_3	H	C_3H_7	CH_3	C_5H_{11}
2-*O*-methylstenosporic acid	CH_3	CH_3	C_3H_7	H	C_5H_{11}
2,2'-di-*O*-methylstenosporic acid	CH_3	CH_3	C_3H_7	CH_3	C_5H_{11}
planaic acid	CH_3	CH_3	C_5H_{11}	CH_3	C_5H_{11}
anziaic acid	H	H	C_5H_{11}	H	C_5H_{11}
miriquidic acid	CH_3	H	$C_2H_5COCH_2$	H	C_5H_{11}
confluentic acid	CH_3	H	$C_5H_{11}COCH_2$	CH_3	C_5H_{11}
2-*O*-methylconfluentic acid	CH_3	CH_3	$C_5H_{11}COCH_2$	CH_3	C_5H_{11}
2-*O*-methyldivaricatic acid	CH_3	CH_3	C_3H_7	H	C_3H_7

The common β-orcinol depsidones stictic acid, norstictic acid and protocetraric acid (which may also occur in *Pertusaria* species) have Rf values less than 0.22. The latter two compounds may be detected by the strong yellow fluorescent spot given by the MBTH reagent alone, before oxidative coupling to produce the coloured azo-derivatives from the phenolic lichen depsides.

ACKNOWLEDGEMENTS

The author is grateful to Dr. J. A. Elix, Chemistry Department, Australian National University, for permission to use the facilities of the Department and for access to synthetic lichen acids for thin layer chromatography.

LITERATURE CITED

Archer, A. W. (1978). 3-Methyl-2-benzothiazolone hydrazone hydrochloride as a spray reagent for phenolic lichen compounds. *J. Chromatogr.*, **152**, 290-292.

Culberson, C. F. & Kristinsson, H. (1970). A standardised method for the identification of lichen products. *J. Chromatogr.* **46**, 85-93.

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen compounds by a standardised thin layer chromatographic method. *J. Chromatogr.*, **72**, 113-125.

Culberson, C. F., Culberson, W. L. & Johnson, A. (1981). A standardised TLC analysis of β-orcinol depsidones. *The Bryologist*, **84**, 16-29.

Elix, J. A. & Crook, C. E. (1992). The joint occurence of chloroxanthones in lichens and a further thirteen new lichen xanthones. *The Bryologist*, **95**, 52-64.

MYCOTAXON

Volume XLVI, pp. 5-9 January-March 1993

OCCURRENCE OF GLOEOPHYLLUM SEPIARIUM (Wulf.:Fr.)Karst. IN INDIA

ANJALI ROY & R.BHATTACHARYA
Department of Botany,Visva-Bharati University, Santiniketan 731 235. W.B. India

SUMMARY

The occurrence of Gloeophyllum sepiarium (Wulf.:Fr.) Karst. in India is confirmed. Pairings between Indian monosporus mycelia and American dikaryotic mycelia were positive.

INTRODUCTION

Gloeophyllum sepiarium (Wulf.:Fr.)Karst. occurs in both the hemispheres of the world but is more common in the temperate regions. It causes a brown rot generally on coniferous woods but also on hardwoods. The occurrence of G.sepiarium in India was questioned by Ryvarden and Johansen (1980) and Parmasto (1988),although Bakshi (1971) had described collections from India. However, we made several collections of this species from India during 1985-1990 and established polysporus and monosporus culture from some of them. Authentic sporophores and cultures were also obtained from other sources. All these were studied critically and the observations are presented in this paper.

MATERIALS & METHODS

Sporophores and cultures used in the study were (a) collected by the authors and are maintained in the Mycological Herbarium of the Visva-Bharati University (VBMH), (b) obtained from Forest Research Institute, Dehra Dun (FRI), and (c) from the United States Dept. of Agriculture (CFMR). The methods used are those of Roy (1979) and Nobles (1948).

The mating system was determined by pairing the monosporus cultures of the fungus (VBMH 86126) amongst themselves. The monosporus cultures were obtained from spore deposits of fresh specimens following standard dilution method.To determine if the isolates from India and America were inter-fertile, a series of di-mon matings were made. Representative monokaryons of each mating type of G.sepiarium (VBMH 86126) were mated with all the other isolates of G.sepiarium. Each mating was done in duplicate. At the end of three weeks hyphae from near the mycelial margin of the homokaryotic

mycelia most distant from the dikaryotic mycelium were examined for the presence of clamp connections. Dikaryotisation of the homokaryon (by Buller phenomenon), as indicated by the presence of clamp connections was evidence of the conspecificity of the paired isolates.

RESULTS & DISCUSSIONS

Gloeophyllum sepiarium

Collections studied:India-VBMH 6994,7214,75125,86126 **,FRI 87a *; United States: CFMR 105468,105469 *.

Basidiocarp annual,sessile,effused-reflexed,solitary or imbricate,coiaceous to corky, 1.0-12 x 1.0-7.2 x 0.2-0.8 cm, margin acute,thin to thick, pileus surface yellowish to reddish brown when fresh, when old brown to snuff brown and scrupose with coarse protuberances, zonate mixed with smooth and hispid bands; context 1-3 mm thick, snuff brown and soft when fresh, reddish brown, flexible to corky when old; pore surface yellowish brown, pores usually lamellar, occasionally daedaloid or poroid towards the base, lamellae often dentate, irregularly spaced, 12-15 per cm.

Hyphal system trimitic. Generative hyphae clamped, hyaline to pale brown, few dark brown,thin-to thick-walled (Fig.1), few solid (Fig.2), 2-4 um wide; skeletal hyphae subhyaline to yellowish brown, usually unbranched, some showing a few apical branches, thick-walled to solid, 2.5-4.5 um wide (Fig.3); binding hyphae hyaline to pale brown,thick-walled to solid, with short branches, 1.5-3.2 um wide (Fig.4), not comon and found only in lower context. Basidia 4-sterigmate, 14-22 x 4.5-6 um (Fig.5). Basidiospores hyaline,cylindric,thin-walled,8.5-12 x 2.5-4.5 um (Fig.6). Cystidia subulate to fusoid,hyaline to subhyaline, thick-walled,smooth,rarely apically encrusted (Fig.7).

ROT: Brown rot.

CULTURAL CHARACTERS:

Growth characters - Growth moderately rapid,plates covered in 3 weeks. Advancing zone sharp,even,mycelium extended to the margin. Aerial mat at first white, thin woolly,later becoming light yellow-brown and subfelty developing fine zonations at the centre and striations towards the periphery. Reverse unchanged initially, later light brown to orange brown. Oxidase test negative on both gallic acid and tannic acid agars.

Hyphal characters: Advancing zone - hyphae hyaline,thin-walled,branched, simple septate, 2-3.5 um wide (Fig.8).

** marks indicate that both fruitbody and culture were studied.

* mark indicates that only culture was studied.

No asterik indicates that only fruitbody was studied.

Aerial mycelium - (a) hyphae as in the advancing zone; (b) hyphae thin- to thick-walled,clamped,2.5-4 um wide,usually hyaline,(Fig.9),some pale yellow and occurring only in the felty region of the mat,often repeatedly branched with short swollen branches (Fig.10); (c) fibre hyphae subhyaline to straw yellow,thick-walled to solid,usually unbranched,few apically biforked, 2.5-4.5 um wide (Fig.11). Chlamydospores subglobose,thick-walled,more commonly terminal,some intercalary, 6-9 x 6.5-12 um. Oidia cylindric,often with fragment of clamp connections attached at one end, 6-13 x 3-4.5 um (Fig.12).
SEXUALITY: Matings between 15 monosporus cultures of G.sepiarium(86126) showed the species to be heterothallic and bipolar. The monosporus isolates were distributed as :

A B 2,3,7,9,11,14
1 1

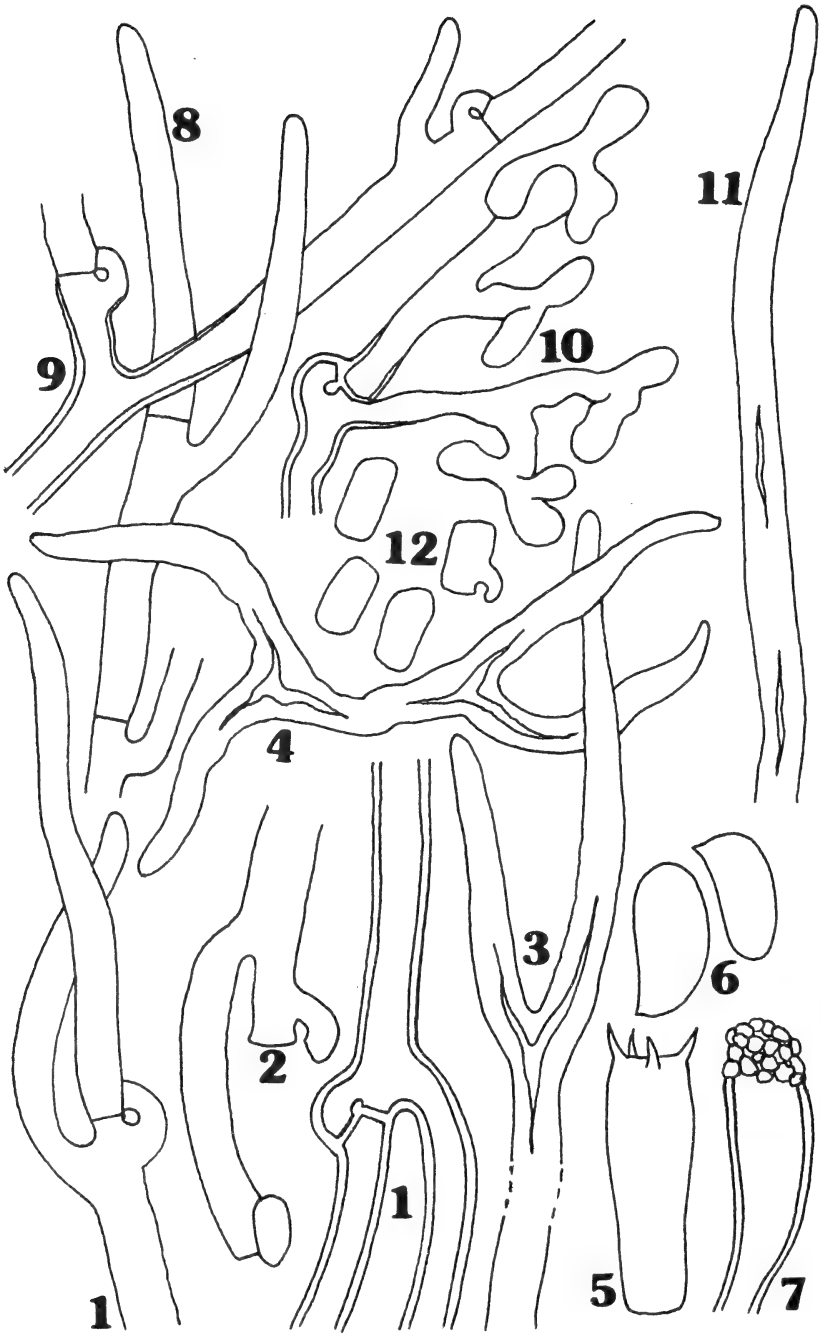
A B 1,4,5,6,8,10,12,13
2 2

This confirms the earlier observations of Nobles (1965).
Incidentally,G.striatum (Swartz.:Fr.)Murr., a closely related species is also bipolar (Roy & De 1979).

DIKARYATIC AND HOMOKARYOTIC PAIRINGS: All pairings of dikaryotic isolates with the homokaryons of G.sepiarium(86126) resulted in the homokaryons being dikaryotised (by Buller phenomenon) after 3 weeks, thus proving the conspecificity of the paired isolates. The pairings were :

G.sepiarium 86126 - 1 x G.sepiarium 87a +
- 4 x 105468 +
- 2 x 105468 +
- 3 x 105469 +

Our collections and the results of pairings established without doubt the occurrence of G.sepiarium in India. The basidiocarps are characterised by often forming daedaloid to round pores towards the base and lamellae elsewhere on the pore surface. Significant cultural characters are the consistent presence of simple septate hyphae in the advancing mycelium and clamped hyphae rearwards, and development of thin- to thick-walled clamped hyphae with repeatedly branched short swelled branches in the aerial mycelium.


8
11
9
10
12
4
3
6
2
1
1
5
7

ACKNOWLEDGEMENTS

The authors are greatly indebted to Dr.J. Ginns, Curator, National Mycological Herbarium of Canada for critically reviewing the manuscript.

REFERENCES

Bakshi,B.K.1971. Indian Polyporaceae (on Trees and Timber). I.C.A.R., New Delhi, India. p.246.

Nobles,M.K.1948. Studies in Forest Pathology VI. Indentification of cultures of wood-rotting fungi. Can.J.Res.C, 26:281-431.

Nobles,M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J.Bot. 43: 1097-1139.

Parmasto,E. 1988. On some Indian Polypores. In: Advances in Mycology, Ed.G.S.Rawla, Panjab University, Chandigarh,India.

Roy, A.1979. Taxonomy of Fomes durissimus Lloyd. Mycologia 71(5):1005-1009.

Roy, A. and A.B.De. 1979. Sexuality in 8 species of Polyporaceae. Mycologia 71(3) : 655 -658.

Ryvarden,L. and I.Johansen. 1980. A preliminary polypore flora of East Africa. Fungiflora Oslo,Norway.p.636.

Figs.1-7. Gloeophyllum sepiarium.Microscopic structures of basidiocarp. 1. thin- to thick-walled generative hyphae.2.Solid generative hypha. 3.Skeletal hypha. 4.Binding hypha.5.Basidia.6.Basidiospores.7.Cystidia.
Figs.8-12. Gloeophyllum sepiarium. Microscopic structures from cultures. 8.Simple septate hyphae from advancing zone.9. Thin- to thick-walled clamped hyphae.10. Clamped hyphae repeatedly branched with short swollen branches. 11. Fibre hypnae. 12.Oidia.

MYCOTAXON

Volume XLVI, pp. 11-18 January-March 1993

CONCERNING THE GENERIC LIMITS IN *HAPLOGRAPHIUM*

Laura Zucconi and Sabina Pagano

Facoltà di Scienze Matematiche, Fisiche e Naturali, Università della Tuscia, Via San Camillo de Lellis, 01100 - Viterbo, Italy

Abstract

The generic value of the presence of chained or aggregated in slimy masses conidia in *Haplographium* is discussed. The first record of *Haplographium heliocephalum* Vasant Rao & de Hoog in Africa is reported.

The genus *Haplographium* was established by Berkeley & Broome in 1859 with the type species *H. delicatum* Berk. & Br.

Hughes (1953) showed that *Hyaloscypha dematiicola* (Berk. & Br.) Nannf. is the perfect state of *H. delicatum* Berk. & Br. and later (Hughes, 1958) he considered *Stilbum catenatum* Preuss (1851) identical with *H. delicatum*; subsequently Holubová-Jechová (1973) proposed, for reasons of priority, the new combination *H. catenatum* (Preuss) Hol.-Jech.

A feature not completely defined in this genus is the presence of chained or aggregated in slimy masses conidia. Berkeley & Broome illustrated the presence in the type species of "masses of catenulate spores arising directly from the apex of the sporophore" (Mason, 1933). Preuss (1851) described *S. catenatum* with "capitulo rotundato albo; sporis primum subconcatenatis, gelatinae immersis". Saccardo (1886), describing the genus *Haplographium* and 16 species in it, reported the presence of conidial chains for the genus and of simple or rarely

branched conidial chains for the type species. In 1920 Pollacci described an human pathogenic species of *Haplographium*, *H. debellamarengoi* (not *H. De Bella Marèngoi*) with conidiophores bearing "ramulis in catenulas conidiorum" (Redaelli, 1925). Arnaud (1954) included the genus *Haplographium* among the *Dématiées amérosporées, à conidies en chaîne s'accroissant par le sommet*. Other two species, *H. atrum* Beeli (1924) and *H. heliocephalum* Vasant Rao & de Hoog (1986) are described by the authors with conidia in chains.

Other authors did not mention the presence of conidial chains. Mason (1933) described a strain of *H. bicolor* Grove (= *H. catenatum*) with numerous spores, abstricted singly, immersed in a dense mucous globule; he also affirmed that Berkeley & Broome had misinterpreted the structure of the head of *H. delicatum* illustrating masses of catenulate spores. Hughes (1953), describing the conidiophores of *Hyaloscypha dematiicola*, the perfect state of *H. catenatum* (cited as *H. delicatum*), observed the presence of a much modified and very condensed *Cladosporium*-type conidiophore fructification and of conidia in slimy masses, never forming chains. Other two species, *H. calophylli* Wiehe (1949) and *H. mangiferae* Deighton (1969) are described by the authors with conidia aggregated in slimy masses. Finally, also Ellis (1971) limited the genus *Haplographium* to those species with conidia aggregated in slimy heads.

During some mycological investigations carried out in the Tai National Park (Ivory Coast), a specimen belonging to the species *Haplographium heliocephalum* Vasant Rao & de Hoog (1986) has been found on *Coula edulis* Baill. leaf in the litter. The presence of this species has been recorded only from India (Vasant Rao & de Hoog, 1986, holotype; Dorai & Vittal, 1988). This is the first record in Africa and also the first record outside India. Our specimen is herewith described. The morphological characteristics were obtained from nature. Every attempt at cultivation on common media proved unsuccessful.

Haplographium heliocephalum was established by Vasant Rao & de Hoog on the base of a specimen found on rotten leaves at Jog Falls, Karnataka, India. The authors described this species as having thin walled conidiophore apices, bearing two orders of branches on which are inserted long acropetal chains of narrow conidia forming apparently dry conidial heads.

Dorai & Vittal (1988) described a new record of *H. heliocephalum*

on leaf litter of *Eucalyptus globulus* collected in the Botanical Garden, Ootacamund, Tamil Nadu, India. Their specimen differs from the type in the presence of "sterile, dark brown, thick-walled, 6-7 septate, smooth" setae associated with the conidiophores, a new feature not found in the type and never reported in any known species of the genus.

Our specimen corresponds with the original description in all the main features but, according to the Dorai & Vittal collection, we noted the occasional presence of long setae, not always associated with the conidiophores. We also noted that sometimes the apical cell of the conidiophore is slightly crenate, a feature which is scarcely perceptible only by the Karnowsky's interferential contrast microscopy. Moreover, Vasant Rao & de Hoog (1986) described for the type "conidiophores often regenerating once near the apex, leaving an irregular, inconspicuous annellation"; we have never seen in our specimen such annellations of the conidiophores but, considering this presence as result of a regeneration process, this may be considered as an occasional phenomenon. Finally, S.E.M. observation shows the presence, in our specimen, of a conidial wall continuity that indicates the presence of true chains with conidia produced in acropetal succession (Fig. 1d); each conidium, after the secession, presents a flat scar at each end, with the only exception of the terminal one which is rounded at the apex (Fig. 1b).

For what regards the conidial heads, reported as "apparently dry" by the authors, we noted, in our specimen, the presence of slimy coverings, evident in moist chamber, which wind round the conidial chains, sometimes confluent. The slimy coverings produce characteristic ellipsoidal structures with a little apical emergence constituted by the terminal conidia of the more central chains (Fig. 1a). The presence of these slimy coverings is probably due to water absorbtion by the conidial walls. The humidity changes could play an important role in the conidial secession, because of hygroscopic mouvements that could ease the conidial detachment (Fig. 1c).

The presence of slimy conidial heads was already observed in the genus *Haplographium* but only in specimens with conidia forming slimy masses and not chains.

On the base of our observations, carried out on the natural media, we think that the humidity rate may surely influence the morphology of the conidial heads. Dal Vesco (1960), studying *H. catenatum* (cited as *H. bicolor* Grove), observed the presence of conidia in chains or not in

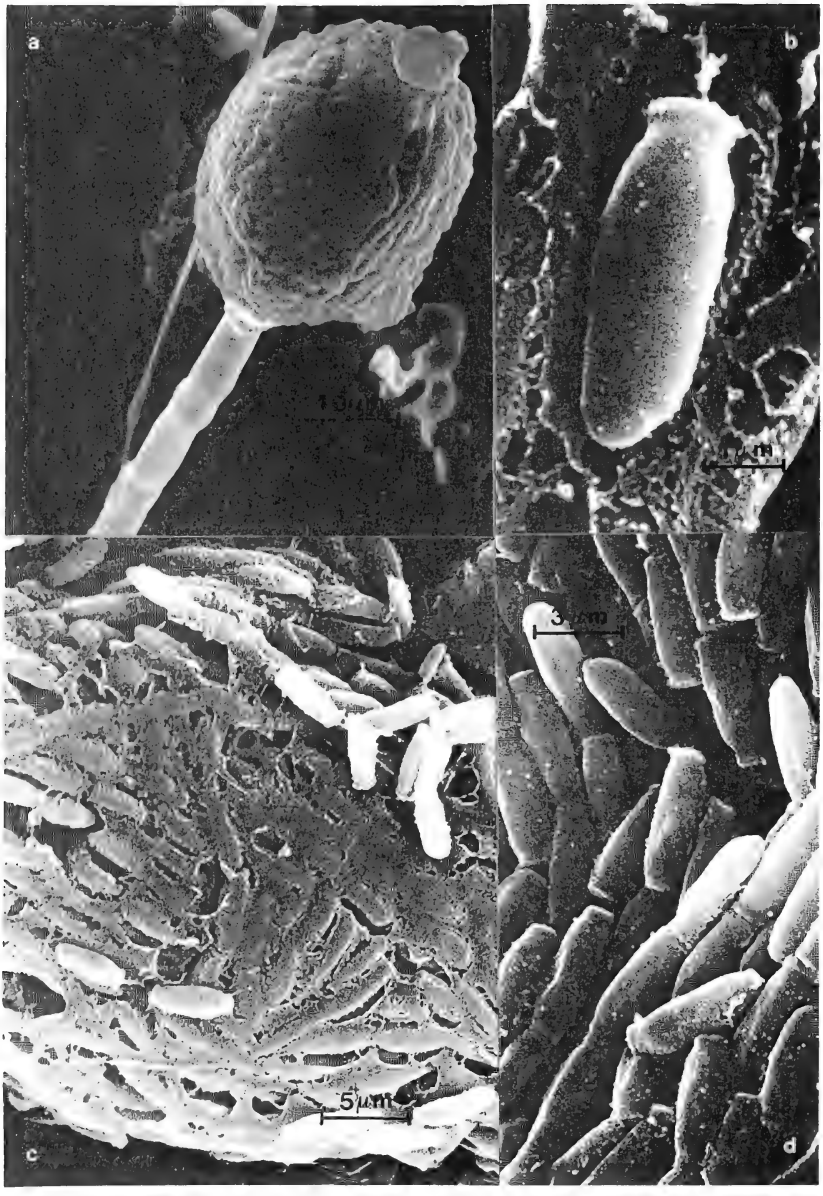


Fig. 1 - *Haplographium heliocephalum*: a. conidiophore and conidial head; b. terminal detached conidium; c. conidial chains in slimy covering and some detached conidia; d. conidial chains free of a slimy covering.

chains depending on the medium and on its humidity rate. Smith (1962), on the base of the contemporaneous presence, in some cultures of *Memnoniella* Höhnel, of conidia in slimy masses and in chains (observed by Zuck in 1946), considered *Memnoniella* Höhnel as synonymous of *Stachybotrys* Corda. In our opinion, and according to Smith (1962), it is surely more important the method of conidial production instead of the morphology of the conidial heads. For these reasons we think that neither the production of conidia in masses or in chains, nor of dry or slimy structures, have to be considered as limitative features at generic level.

The description of the African record is the following:

Haplographium heliocephalum Vasant Rao & de Hoog, 1986, *Studies in Mycology* **28**: 56-58 (Fig. 2)

Colonies amphigenous, effuse, uncircumscribed, with wide and snow-white conidial heads on scattered, blackish stalks. Mycelium immersed. Setae slender, up to 12 septate, dark brown, thick walled, smooth, up to 450 µm long, 4-4.5 µm wide at the base, gradually tapering to 2-2.5 µm at the apex. Conidiophores macronematous, mononematous, erect, straight or slightly flexuous, solitary, smooth, septate (with few distant septa), rather thick walled and brown near the enlarged base, thinner walled and paler at the subhyaline apex, 110-170 x 4.2-4.7 µm. Conidiogenous cells polyblastic, terminal on the stipe, consisting of one regular series of several (3 at least) primary metulae, the distal ends bearing conidia or secondary metulae. Primary metulae thin walled, smooth, hyaline, 6.5-8.5 x 2-4.5 µm; secondary metulae narrower, hyaline, bearing conidia or, more frequently, becoming ramo-conidia. Conidia catenate, in branched acropetal chains, simple, smooth, thin-walled, hyaline, cylindrical to ellipsoidal, with a flat scar at each end, 4.0-5.5 x 1-2 µm; ramo-conidia frequent, at the beginning or along the chain.

Specimen examined: R.O.H.B. 303 on *Coula edulis* Baill. in litter, Tai, Ivory Coast, A. Rambelli, 30 Nov. 1989.

Acknowledgements

The authors wish to thank Dr. V. Holubovà-Jechovà (Botanical

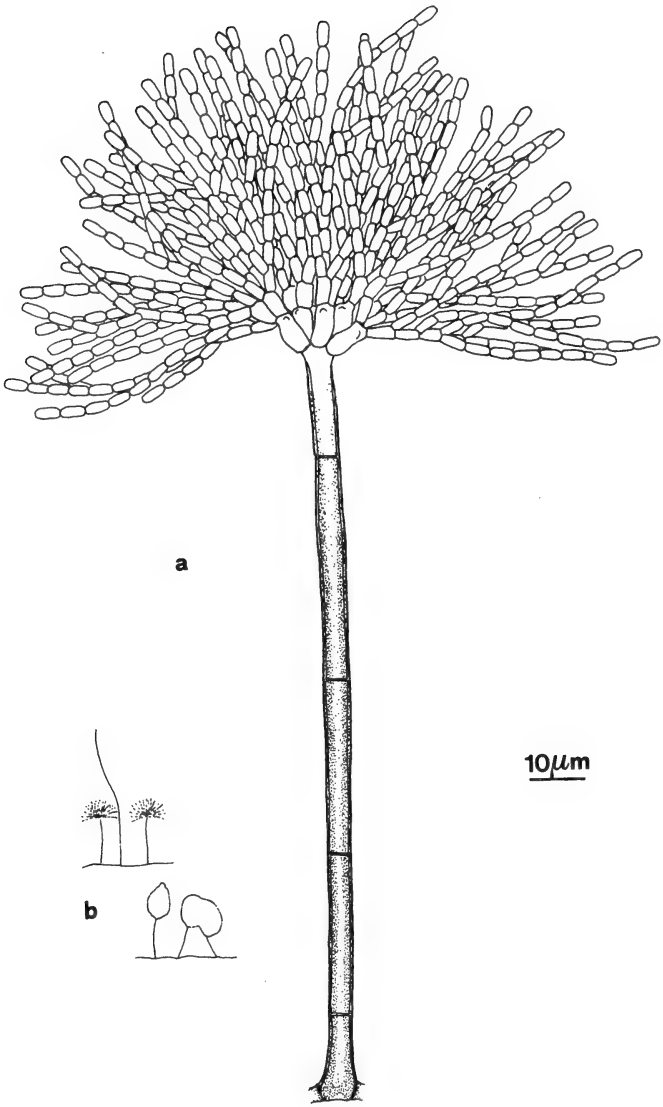


Fig. 2 - *Haplographium heliocephalum*: a. conidiophore and conidial chains; b. habit sketchs.

Institute, Czechoslovak Academy of Sciences, Pruhonice near Praha, Czechoslovakia) for reviewing the manuscript and Prof. A. Rambelli and Prof. S. Onofri (Università della Tuscia, Viterbo, Italy) for their comments. Dr. V. Rao (Osmania University, Hyderabad, India) helped with some bibliographic material.

References

Arnaud, G. 1954. Mycologie concrète: Genera II (suite et fin). *Bulletin trimestriel de la Société Micologique de France* **69**: 265-306.

Beeli, M. 1924. Notes Micologiques. Champignons nouveaux pour la Flore belge, récoltés de 1915 a 1923. *Bulletin de la Société Royale de Botanique de Belgique* **61**: 57-68.

Dal Vesco, G. 1960. Contributo alla conoscenza della micoflora di boschi di Pino laricio della Sila. *Allionia* **6**: 201-226.

Deighton, F.C. 1969. New genera and species and redispositions of some Hyphomycetes, mainly African. In: Cejp K. & Deighton F.C., Microfungi III. *Mycological Papers* **117**: 8-31 .

Dorai, M. & Vittal, B.P.R. 1988. Additional notes on *Haplographium heliocephalum*. *Current Science* **57**: 1127-1128.

Ellis, M.B. 1971. *Dematiaceous Hyphomycetes*. Commonwealth Mycological Institute, Kew, Surrey, England.

Holubová-Jechová, V. 1973. Lignicolous Hyphomycetes from the Netherlands. *Koninklijke Nederlandse Akademie van Wetenschappen, Ser.* C, **76**: 297-302.

Hughes, S.J. 1953. Conidiophores, conidia, and classification. *Canadian Journal of Botany* **31**: 576-659.

Hughes, S.J. 1958. Revisiones Hyphomycetum aliquot cum appendice de nominibus rejiciendi. *Canadian Journal of Botany* **36**: 727-836.

Mason, E.W. 1933. Annotated account of Fungi received at the Imperial Mycological Institute. List II, fascicle 2. *Mycological Papers* **3**: 61-63.

Preuss, G.T. 1851. Uebersicht untersuchter Pilze besonders aus der Umgegend von Hoyerswerda. *Linnaea* **24**: 99-153.

Rao, V. & de Hoog, G.S. 1986. New or critical Hyphomycetes from India. *Studies in Mycology* **28:** 56-58.

Redaelli, P. 1925. *I miceti come associazione microbica nella tubercolosi polmonare cavitaria*. Pavia.

Saccardo, P.A. 1886. *Sylloge fungorum omnium hucusque cognitorum.* Vol. **IV**. Pavia.

Smith, G. 1962. Some new and interesting species of micro-fungi. III. *Transactions of the British mycological Society* **45**: 387-394.

Wiehe, P.O. 1949. Wilt of *Callophyllum inophyllum* L. caused by *Haplographium calophylli* in Mauritius. *Mycological Papers* **29**: 1-11.

Zuck, R.K. 1946. Isolates intermediate between *Stachybotrys* and *Memnoniella. Mycologia* **38**: 69-76.

MYCOTAXON

Volume XLVI, pp. 19-26 January-March 1993

ADDITIONS TO MYCOSPHAERELLA IN THE FYNBOS BIOME

P.W. CROUS
Department of Plant Pathology, University of Stellenbosch, 7600 Stellenbosch, South Africa

AND

M.J. WINGFIELD
Department of Microbiology and Biochemistry, University of the Orange Free State, P.O. Box 339, 9300 Bloemfontein, South Africa

The vegetation occurring in the winter rainfall region at the southern tip of Africa (fynbos biome), covers the smallest geographic area, yet has the most diverse floral kingdom (Goldblatt, 1978; Bond & Goldblatt, 1984; Takhtajan, 1986). Although plants occurring in this biome have received considerable attention, very little attention has been given to fungi associated with these plants (Knox-Davies, Van Wyk & Marasas, 1986). During routine collections of fungi causing leaf spots on plants occurring in the fynbos, two unfamiliar leaf spot diseases were observed on leaves of *Protea repens* (L.) L. and *Cussonia thyrsiflora* Thunb. respectively. A closer examination of the symptomatic leaves showed that the leaf spots on both hosts were associated with species of *Mycosphaerella* Johnson. As far as we could establish, no species of *Mycosphaerella* has previously been described from leaves of *Cussonia* Thunb. In contrast, two species of *Mycosphaerella, M. proteae* (H.P Sydow) Von Arx and *M. jonkershoekensis* Van Wyk, Marasas & Knox-Davies occur on *Protea* leaves (Van Wyk, Marasas & Knox-Davies, 1975a, 1975b). The aim of this study was to provide an identification for the two *Mycosphaerella* species associated with leaf spot symptoms on *Cussonia* and *Protea* L.

Mycosphaerella proteae has several acknowledged synonyms, and is known from numerous species of *Protea* (Van Wyk *et al.*, 1975a). This

fungus (PREM 44925) is characterised by ascospores that are widest in the middle of the upper cell as arranged in the ascus, and taper to the lower end and measure 20.0-(26.0)-33.0 x 6.0-(7.0)-8.0 μm (averages in brackets). Ascospores are bi- or triseriate in the ascus, hyaline, germinating with germ tubes parallel to the long axis of the ascospore. Ascospores are unequally septate, with longer basal cells (Fig. 1).

Van Wyk *et al.* (1975b) described a second species of *Mycosphaerella* from *Protea* leaves, and assigned the name *M. jonkershoekensis* Van Wyk, Marasas & Knox-Davies to this fungus. Ascospores of the holotype of *M. jonkershoekensis* (PREM 44830) are widest in the middle of the upper cell as arranged in ascus, frequently taper to both ends, and measure 11.0-(18.0)-23.0 x 4.0-(4.5)-6.0 μm. Ascospores are tri- or multiseriate in ascus, becoming light brown, slightly spirally twisted and elongated with age, and ranging from not constricted to prominently constricted at the median septum (Fig. 2).

The species of *Mycosphaerella* collected from *P. repens* leaves in this study was associated with similar symptoms to those found on leaves infected by *M. jonkershoekensis*. It could, however, easily be distinguished from both *M. proteae* and *M. jonkershoekensis* on the basis of its ascospores, which were much smaller than those of the other two species. Because of its distinct morphology, this fungus is described as a new species as follows:

Mycosphaerella bellula Crous & Wingf. *sp. nov.* Figs 3-4
Etym.: *bellulus*, diminutive of *bellus*, meaning pretty or elegant.

Laesiones amphigenae, circulares, depressae, pallide brunneae, cinctae margine brunneo elevato. Ascocarpi amphigeni, nigri, obpyriformi ad subglobosi, subepidermales, infra stomata immersi, 90.0-150.0 μm lati, 80.0-130.0 μm alti, parietes ex cellulis medio-brunneis constantes, 4-5 strata texturae angularis; basis ex 3-4 stratis cellularum hyalinarum constans. Asci bitunicati, aparaphysati, subsessiles, octospori, cylindrici usque ad obpyriformes, 30.0-(45.7)-58.0 x 7.0-(8.0)-10.0 μm. Ascosporae 2-3 seriatae, vel irregulariter dispositae, obliquae, imbricatae, rectae ellipsoideae, in extremitatibus obtusae, hyalinae, laeves, medi-septatae, guttulatae, ad septum constrictae, latissimae in parte media cellulae superioris, 7.0-(8.8)-11.0 x 2.0-(2.5)-3.0 μm.

Holotypus: *Protea repens* (L.) L., Stellenbosch Mountain, Stell., RSA, 30 Aug. 1991, P.W. Crous, PREM 51028.

Lesions amphigenous, circular, sunken, light brown with a raised, dark brown margin. *Ascocarps* amphigenous, black, obpyriform to subglobose, subepidermal and immersed below stomata, 90.0-150.0 μm wide, 80.0-130.0 μm high; walls consisting of medium brown cells, 4-5 layers of *textura angularis*, base consisting of 3-4 layers of hyaline cells; developing in a substomatal chamber, becoming erumpent through stomatal pore. *Asci* bitunicate, aparaphysate, subsessile, 8-spored, cylindrical to obpyriform, 30.0-(45.7)-58.0 x 7.0-(8.0)-10.0 μm, up to 20 per ascocarp. *Ascospores* bi- to triseriate or irregularly arranged, oblique, overlapping, straight, ellipsoidal, obtuse at each end, hyaline, smooth, median septate, guttulate, constricted at septum, widest in middle of upper cell as arranged in ascus, 7.0-(8.8)-11.0 x 2.0-(2.5)-3.0 μm.

Specimen examined: *Protea repens*, Stellenbosch Mountain, Stell., RSA, 30 Aug. 1991, P.W. Crous, PREM 51028, holotype.

The second species of *Mycosphaerella* collected in this study occurred on leaves of *Cussonia thyrsiflora*. Two other leaf spot fungi are commonly encountered on *Cussonia* species in South Africa. *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc., which is the cause of anthracnose lesions on several hosts (Baxter, Van der Westhuizen & Eicker, 1983), was commonly isolated from light-brown, concentric lesions on the margins of *Cussonia* leaves in this study. Another fungus, *Phyllosticta cussoniae* Cejp, has also been described from lesions occurring on leaves of *Cussonia umbellifera* Sond. in the Transvaal Province (Cejp, 1971).

Spermagonia were first observed on leaf spots of *Cussonia thyrsiflora* in 1989. The subsequent development of pseudothecia among spermagonia was mostly associated with the appearance of prominent leaf spots. To the best of our knowledge no *Mycosphaerella* sp. has yet been recorded from this host (Corlett, 1991), and this collection is therefore described as new:

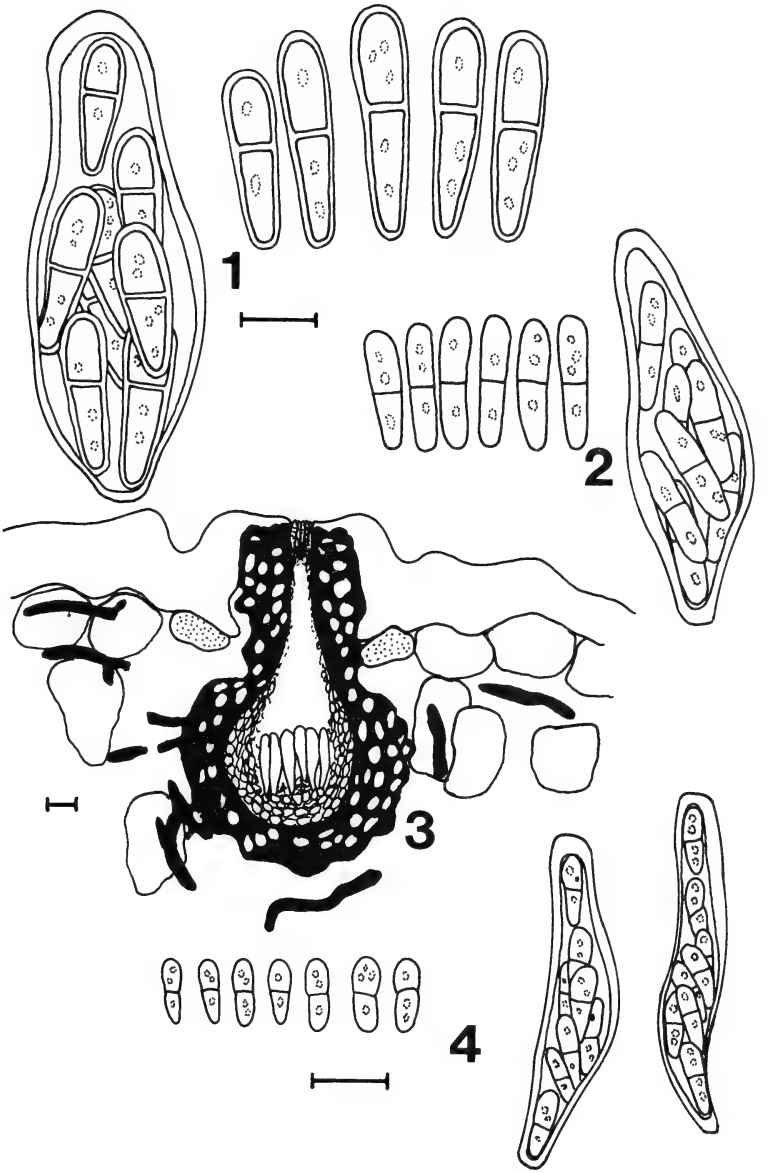
Mycosphaerella cussoniae Crous & Wingf. *sp. nov.* Figs 5-6

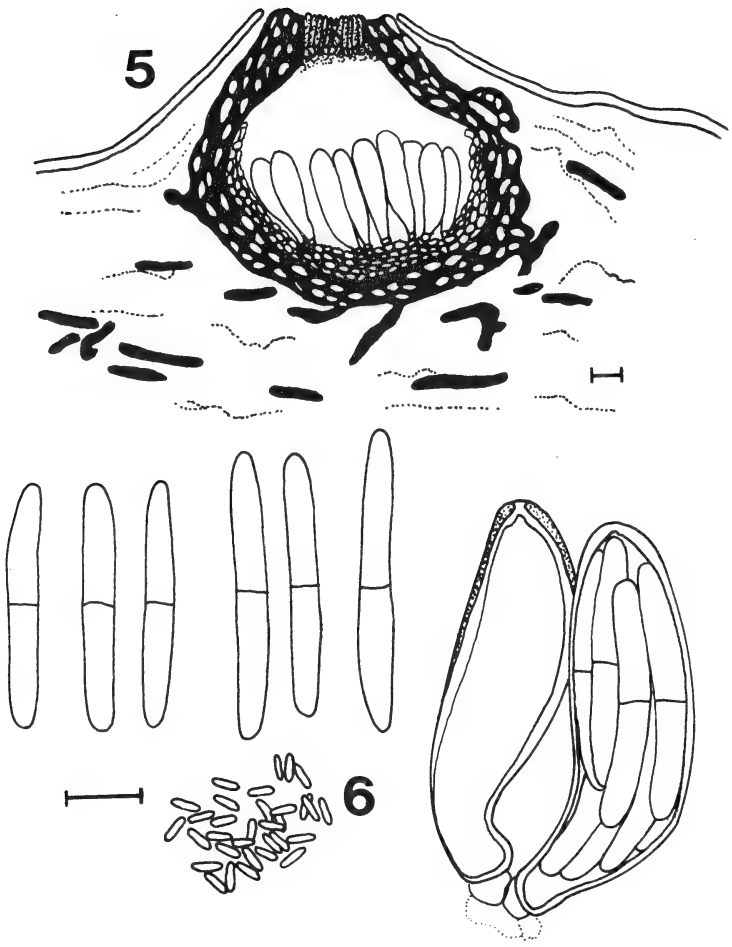
Laesiones amphigenae, circulares ad irregulares, depressae, pallide brunnae, cinctae margine tenui eminenti pallide brunneo elevato, 0.5-3.0 cm diam. Ascocarpi hypophylli, nigri, subglobosi, subepidermales, erumpentes, papillati, 90.0-120.0 μm lati, 80.0-100.0 μm alti, apicale papillatum ostiolum usque ad 30 μm diam., parietes ex cellulis medio-brunneis constantes, 5-6 strata texturae angularis, basis ex 3-4 stratis hyalinarum cellularum constans. Asci bitunicati, aparaphysati, subsessiles, octospori, fusiformes, numerosi, 40.0-(55.0)-65.0 x 10.0-(15.0)-17.0 μm. Ascosporae hyalinae, tri- vel multiseriatae, obliquae, imbricatae, recte ellipsoideae, obtusae in extremitatibus, hyalinae, laeves, mediano septatae, guttulatae non ad septum constrictae, latissimae in media parte ascosporae, attenuatae in extremitatibus, 26.0-(35.0)-40.0 x (4.0)-6.0 μm. Spermagonia structura pseudotheciorum similia; 70.0-110.0 x 70.0-90.0 μm diam. Parietes pseudoparenchymatici 3-4 stratis. Spermatia hyalina, bacilliformia, aseptata, 3.0-5.0 x 1.0 μm.

Holotypus: *Cussonia thyrsiflora* Thunb., Betty's Bay, RSA, Sept. 1989, P.S. Knox-Davies, PREM 51027.

Lesions amphigenous, circular to irregular, sunken, light brown with a raised, thin, light brown margin, 0.5-3.0 cm diam. *Ascocarps* hypophyllous, black, subglobose, subepidermal, erumpent, papillate, 90.0-120.0 μm wide, 80.0-100.0 μm high; apical papillate ostiole up to 30.0 μm diam.; walls consisting of medium brown cells, 5-6 layers of *textura angularis*, base consisting of 3-4 layers of hyaline cells. *Asci* bitunicate, aparaphysate, subsessile, 8-spored, fusoid, numerous, 40.0-(55.0)-65.0 x 10.0-(15.0)-17.0 μm. *Ascospores* hyaline, tri- or multiseriate, oblique, overlapping, straight, ellipsoidal, obtuse at each end, hyaline, smooth, medianly septate,

Figs 1-4. Pseudothecium, asci and ascospores of *Mycosphaerella* spp. occurring on *Protea* spp. (bar = 10 μm). Fig. 1. Ascus and ascospores of *M. proteae* (PREM 44925). Fig. 2. Ascus and ascospores of *M. jonkershoekensis* (PREM 44830, holotype). Fig. 3. Vertical section through pseudothecium of *M. bellula*. Fig. 4. Asci and ascospores of *M. bellula* (PREM 51028, holotype).


1
2
3
4



Figs 5-6. Pseudothecium, ascospores, asci and spermatia of *Mycosphaerella cussoniae* (PREM 51027, holotype) (bar = 10 μm). Fig. 5. Vertical section through pseudothecium. Fig. 6. Ascospores, asci and spermatia.

guttulate, not constricted at septum, widest in middle of spore, tapering to both ends, 26.0-(35.0)-40.0 x (4.0)-6.0 μm. Spermagonia similar to pseudothecia in structure, light brown, 70.0-110.0 x 70.0-90.0 μm diam., pseudoparenchymatous wall 3-4 layered, spermatia hyaline, rod shaped, aseptate, 3.0-5.0 x 1.0 μm.

Specimens examined: *Cussonia thyrsiflora*, Betty's Bay, RSA, Sept. 1989, P.S. Knox-Davies, PREM 51027, holotype; *C. thyrsiflora*, Betty's Bay, RSA, Sept. 1991, P.S. Knox-Davies, PREM 51030.

Cussonia spp. are common ornamental plants and *Protea* spp. are used for ornamental purposes as well as for cut flowers. Other than being of mycological interest, the description of *M. bellula* and *M. cussoniae* could also ultimately be of plant pathological significance. It is likely that many other interesting and important fungi occur on fynbos plants. Efforts are, therefore, underway to ensure that these fungi receive the attention that they deserve.

ACKNOWLEDGEMENTS

We thank Dr M. Corlett (Centre for land & Biol. Resources Res., Canada), for reviewing the manuscript, and Mr E.G.H. Oliver (National Botanical Institute, Stellenbosch), for checking the Latin diagnosis. Prof P.S. Knox-Davies, Department of Plant Pathlogy, University of Stellenbosch, is also thanked for collections of *M. cussoniae*.

REFERENCES

Baxter, A.P., Van der Westhuizen, G.C.A. & Eicker, A. (1983). Morphology and taxonomy of South African isolates of *Colletotrichum*. *South African Journal of Botany* **2**: 259-289.

Bond, P. & Goldblatt, P. (1984). Plants of the Cape flora: a descriptive catalogue. *Journal of South African Botany* (*Supplement*) **13**: 1-455.

Cejp, K. (1971). Some members of the Sphaeropsidales from South Africa. *Bothalia* **10**: 341-345.

Corlett, M. (1991). An annotated list of the published names in *Mycosphaerella* and *Sphaerella*. *Mycological Memoir* **18**: 1-328.

Goldblatt, P. (1978). An analysis of the flora southern Africa: its characteristics, relationships and origins. *Annals of the Missouri Botanical Garden* **65**: 369-436.

Knox-Davies, P.S., Van Wyk, P.S. & Marasas, W.F.O. (1986). Diseases of Proteas and their control in the South Western Cape. *Acta Horticulturae* **185**: 189-200.

Takhtajan, A. (1986). Floristic regions of the world. Univ. of California Press, Berkeley.

Van Wyk, P.S., Marasas, W.F.O. & Knox-Davies, P.S. (1975a). Ascomycetous leaf pathogens of *Protea*, *Leucadendron* and *Leucospermum* in South Africa. *Phytophylactica* **7**: 91-94.

Van Wyk, P.S., Marasas, W.F.O. & Knox-Davies, P.S. (1975b). *Teratosphaeria protea-arboreae* and *Mycosphaerella jonkershoekensis*, two new ascomycetes on *Protea* in South Africa. *Journal of South African Botany* **41**: 231-238.

MYCOTAXON

Volume XLVI, pp. 27-33 January-March 1993

TWO NEW SPECIES OF INOCYBE FROM JAPAN

Takahito Kobayashi

Laboratory of Biology, Faculty of Education
Shiga University, Otsu 520, Japan

and

Regis Courtecuisse

Laboratoire de Botanique et Cryptogamie
Faculte des Sciences Biologiques & Pharmaceutiques
BP 83, F-59006, Lille Cedex, France

KEY-WORDS: Inocybe pseudorhacodes; Inocybe chrysochroa; new species; Japan.

SUMMARY

Two new species, viz. Inocybe pseudorhacodes and I.chrysochroa are described from deciduous forest of Japan.

The genus Inocybe has included a large number of species. Various taxa were reported by Imai (1938), Imai (1941), Y.Kobayasi (1952) and Hongo (1959) from Japan.

Two new species of Inocybe are described and illustrated in this report.

All specimens cited in this paper are deposited in herbaria of the Tottori Mycological Institute (TMI), the Natural History Museum and Institute, Chiba (CBM-FB), the author's private herbarium (TAKK), Otsu, and Hongo Herbarium (HONGO), Otsu, Japan.

The color terms used are those from Kornerup & Wanscher (1978) or refer to Munsell notation.

For microscopic observation, dried specimens were hydrated in 5% KOH solution or 10% NH4OH solution. Value of spores excluded apiculus. Value of basidia excluded sterigma. Value of metuloids excluded crystals.

Index of slenderness is defined as

$$IS=\frac{l^2}{d\times D}$$

where,
l: length of stipe,
d: diameter of stipe,
D: diameter of pileus.
This index is quoted from Kuyper (1986).

Inocybe pseudorhacodes Takahito Kobayashi & Regis Courtecuisse sp. nov.

Fig. 1.

Pileo -32 mm lato, subumbonato, brunneo, squarroso. Lamellis adnatis, castaneis. Stipite 22-38(-49) x 2.6-4.8 mm, aequali, solido, cremeo-brunneo, fibrilloso, fibrillis brunneolis cingulato. Carne alba.
Sporis 6.9-8.6 (-9.5) x 4.1-5.1 µ, Q=1.5-1.8, amygdaliformibus, brunneis. Basidia 13-22 x 6-10 µ, tetra-sporica, pallido luteis. Pleurocystidiis 52-72 x 12-17 µ, metuloideis, luteis. Cheilocystidiis catenulatis, brunneis. Holotypus (TMI 16012 (= TAKK 911-1)).

Pileus 21-32 x -11 mm, when young convex, then subumbonate, finally plano-concave with reflexed margin, brown (7D6) to dark brown (7F7), recurvately squarrulose. Lamellae subventricose, adnate, close, 0.9-1.1 mm broad at middle, reddish brown, brownish orange (6C4) to brown (6E7), edge flocculose, pale brown. Stipe 22-38(-49) x 2.6-4.8 mm, equal or slightly broadened toward base, solid, creamy brown to grayish orange (5B3,5B4,5B5), at apex slightly rough, not pruinose, surface longitudinally fibrillose, with brownish incomplete girdles (7E7,7F7). Context white, 0.4-1.4 mm thick, at umbo up to -2.7 mm. Odor indistinct. IS=0.67-1.63, on average 1.08. Spore print brown.
Spores 6.9-8.6 (-9.5) x 4.1-5.1 µ, Q=1.5-1.8, smooth, amygdaliform with papillate to acute apex, brownish orange in KOH (5%). Basidia 13-22 x 6-10 µ, 4-spored, always pale yellow in KOH. Pleurocystidia 52-72 x 12-17 µ, sublageniform, sometimes slenderly fusiform to slenderly utriform, a few with yellowish brown plasmatic pigment, wall up to 3.2 µ thick, yellow in KOH. Cheilocystidia catenate, up to 21-64 µ, thin-walled, yellowish in KOH, almost filled with brown plasmatic pigment. Marginal metuloids also present, 36-80 x 12-20 µ, wall up to 3.2(-3.8) µ thick, similar to pleurocystidia. Hymenophoral trama regular to subregular, made of hyphae 4.2-8.0 µ in diam. Caulocystidia on apex of stipe catenate, up to 31-82 µ, thin-walled, yellowish in KOH, almost filled with brown plasmatic pigment, the terminal cells 21-45 x 15-21 µ, broadly ellipsoid to ventricose-rostrate; metuloids rarely present, 42-74 x 9-20 µ, wall up to 2.2(-3.2) µ thick, in KOH yellowish wall, sometimes with brown plasmatic pigment at apex, sublageniform, the wall yellowish in KOH, up to 2.2-(3.2) µ. Caulocystidia on middle of stipe scanty,

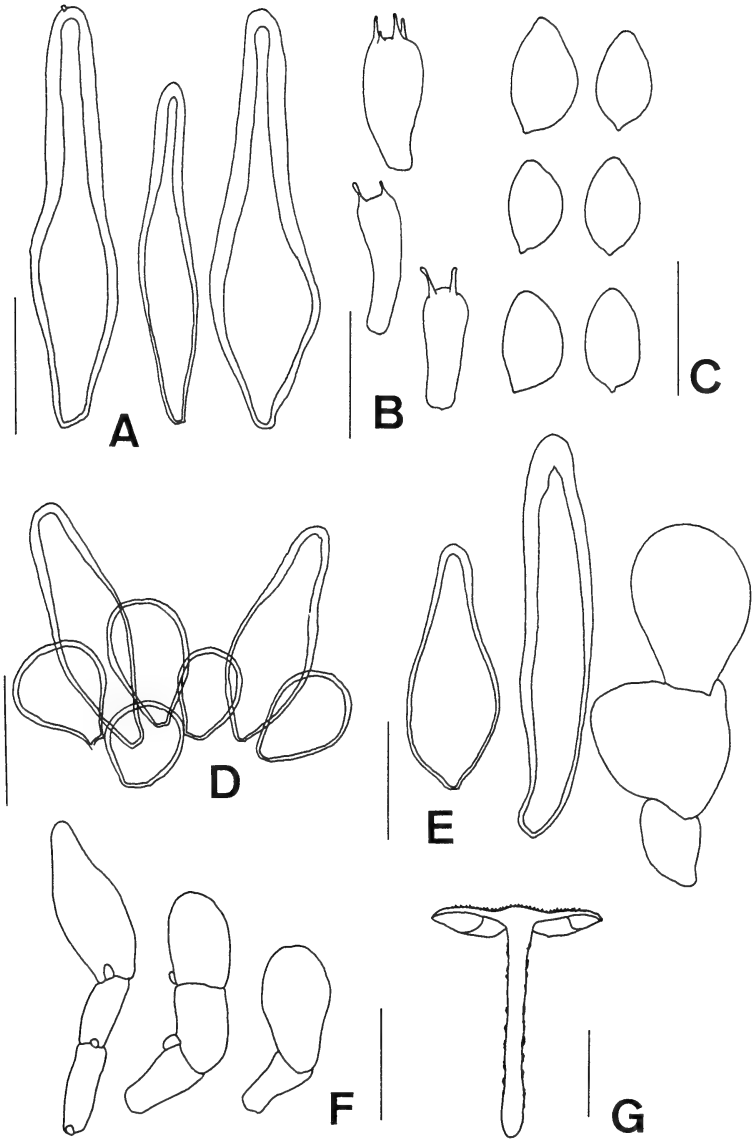


Fig. 1. Inocybe pseudorhacodes T. Kobayashi & R.Courtecuisse A, pleurocystidia; B, basidia; C, basidiospores; D, cheilocystidia; E, cystidia at apex of stipe; F, trichodermal elements on surface of pileus; G, carpophores; Scale bars: A-B,D-F=20 µ, C=10 µ,G=1 cm.

thin-walled, mixed with metuloids similar to those on apex. Caulocystidia on the base of stipe none, replaced by cylindrical hyphae (4.4-8.0 μ diam) from lower quarter down to the base, brown. Cuticle a trichoderm of cylindrical hyphae ,7-12(-15) μ diam, almost filled with brown plasmatic pigment. Clamp connections present.

COLLECTIONS EXAMINED. - Nakanojyo-machi, Agatuma-gun, Gunma-pref., deciduous forest, Sept.15,1989, coll. T.Kobayashi (TMI 16012 (=TAKK 911-1)): holotype, (CBM-FB 4381 (=TAKK 911-2)): isotype.

This Inocybe belongs to subgenus Inocybe super-section Cortinatae.

Inocybe pseudorhacodes resembles I.rhacodes J.Favre, but has caulocystidia, smaller spores and broadly ellipsoid to ovoid terminal element of cheilocystidia. I.destruens Horak differs in a different color of context of stipe, and lacking brownish girdles of stipe and having very thick-walled cystidia.

Inocybe chrysochroa Takahito Kobayashi & Regis Courtecuisse sp. nov.

Fig. 2.

SELECTED ICON. Imazeki & Hongo, Colored Illustrations of Mushrooms of Japan Vol. 1: pl. 54/389, 1987 (as I.paludinella).

Pileo -17(-28) x 3-13 mm lato, umbonato, luteo-brunneo, fibrilloso, rimoso, lubrico. Lamellis adnexis, griseo-violaceis, dein griseo-brunneolis. Stipite 21-26(-40) x 1.8-3.9 mm, marginato-bulboso, solido, flavido, farinaceo. Carne alba.

Sporis (7.0-)8.8-10.4(-11.9) x (6.5-)7.2-9.4 μ, Q=1.0-1.3, nodulosis, brunneis. Basidia (21-)24-36 x 8-12 μ, tetra-sporica. Pleurocystidiis (40-)45-66(-71) x 14-23 μ, metuloideis. Cheilocystidiis 31-51 x 13-20 μ, metuloideis. Holotypus (TMI 16015 (=TAKK 1303-1)).

Pileus -17(-28) x 3-13 mm, when young paraboloid with involute margin, then umbonate with straight margin, reddish yellow (7.5YR 6/6) to strong brown (7.5YR 5/6) when young, then brown (7.5YR 4/4), greyish orange (5B4), dark reddish brown (2.5YR 2.5/4) on the umbo, fibrillose, squarrose, sometimes with polygonal scales, rimose, lubricous when wet, silky when dry, white velipellis absent. Lamellae subventricose, adnexed, spottedly colored on sides, close, (0.3-)0.6-0.9 mm broad at middle, when young reddish grey (8B2) to grey (8B1), then light brownish grey (10YR 6/2) to greyish brown (10YR 5/2), edge flocculose, white. Stipe 21-26(-40) x 1.8-3.9 mm, -4.7 mm broad at base, emarginately bulbous, rarely indistinctly

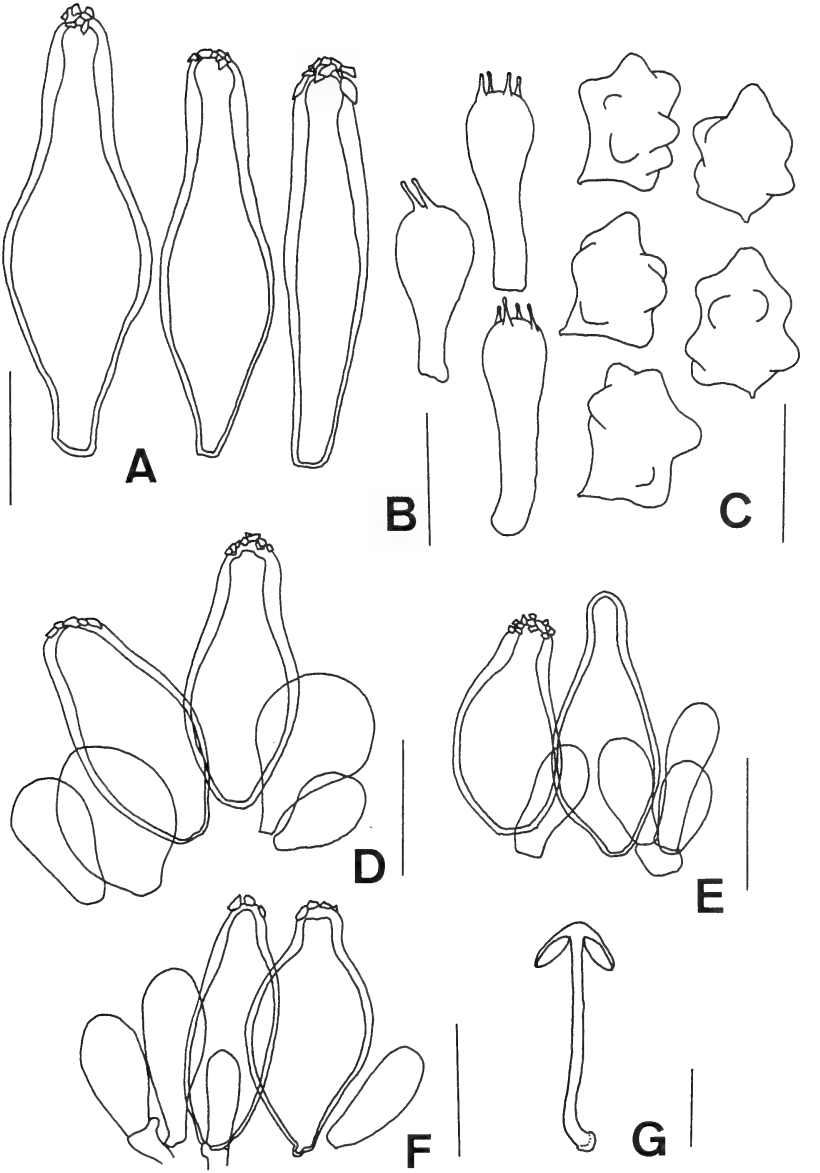


Fig. 2. Inocybe chrysochroa T.Kobayashi & R.Courtecuisse
A, pleurocystidia; B, basidia; C, basidiospores;
D, cheilocystidia; E, cystidia at apex of stipe;
F, cystidia at base of stipe; G, carpophores;
Scale bars: A-B,D-F=20 µ, C=10 µ, G=1 cm.

emarginate, solid, pale yellow (4A3) to yellowish white (4A2), rarely with reddish tint, surface farinaceous, silky, slightly striped. Context yellowish white (4A2) to white (4A1), in pileus 0.2-0.7 mm thick, at umbo up to -2.2 mm. Odor indistinct or none. IS=1.02-4.71, on average 2.32. Spore print strong brown (7.5YR 4/6).

Chemical reactions on pileus and lamellae: KOH (5%) negative, FeCl3 (20%) olive black. On stipe: FeCl3 (20%) tawny olive.

Spores (7.0-)8.8-10.4(-11.9) x (6.5-)7.2-9.4 µ, Q=1.0-1.3, gibbose in all views, 6-7 nodules visible on polar view. Basidia (21-)24-36 x 8-12 µ, short, clavate, 4-spored. Pleurocystidia (40-)45-66(-71) x 14-23 µ, broadly ventricose to narrowly utriform with a short pedicel, the wall 2.6-3.4 µ thick, slightly yellowish in KOH (5%). Cheilocystidia 31-51 x 13-20 µ, ventricose to broadly ventricose, sometimes with pedicellate base, the wall 2.8-3.2 µ thick, slightly yellowish in KOH; thin-walled cheilocystidia mixed with metuloids, ellipsoid to ovoid, frequently catenate ,total length (10-)13-20 µ. Hymenophoral trama regular, made of hyphae (3.0-)4.2-6.0(-8.0) µ in diam. Caulocystidia on apex of stipe (36-)41-67(-75) µ, broadly ventricose to narrowly utriform, sometimes with pedicellate base, the wall 3-4.2 µ thick, slightly yellowish in KOH; thin-walled caulocystidia clustered with metuloids, ellipsoid to narrowly clavate ,18-27(-29) µ, sometimes catenate; clusters rather abundant. Caulocystidia on middle of stipe similar in morphology to the apical ones; clusters rather scanty. Caulocystidia on base of the stipe identical; clusters rather abundant. Superficial hyphae with cystidioid terminal cells also present on the stipe, abundant. Pileipellis of the cutis type, duplex, with the suprapellis up to 31 µ deep, subregular to regular, with agglutinated hyphae 2.2-3.4(-3.8) µ in diam, the wall slightly yellowish in KOH and subpellis up to 42 µ deep, made of regular to subregular hyphae (3.0-)4.2-7.0(-9.0) µ in diam, the wall brownish in KOH. Clamp connections present.

COLLECTIONS EXAMINED. - Senjo, Shiga-pref., Under Quercus serrata, Jul,17,1964, (HONGO 892); Under Castanea, Quercus and Pinus, etc., [Jun,24.1991, (TAKK 1150); Jun,26,1991, (TMI 16013 (=TAKK 1152)); Jul,21,1991, (TMI 16015 (=TAKK 1303-1): holotype, (CBM-FB 4382 (=TAKK 1303-2)): isotype; Jul,22.1991, (TMI 16016 (=TAKK 1308); Aug,1,1991, (TAKK 1331); Oct,10.1991, (TAKK 1533)];

Hiratu, Shiga-pref., Under Castanea, [Jun,26,1991, coll. Hisayasu Kobayashi (TMI 16014 (=TAKK 1154)); Sept.9.1991, (CBM-FB 4279 (=TAKK 1462-1)); Oct,8,1991, coll. H.Kobayashi (CBM-FB 4383 (=TAKK 1527)); Oct,14,1991, (CBM-FB 4384 (=TAKK 1564-1)); Oct,22,1991, coll. T.Kobayashi & Naoko Nakao, (CBM-FB 4385 (=TAKK 1596))];

Omi-jingu, Otsu-city, Shiga pref., [Gregarious on the ground in plantation, Oct,4,1957, (HONGO 1677); Scattered

on humus in plantation, Jul,8,1958 (HONGO 1807); Gregarious on the ground in plantation, Jul,22,1958, (HONGO 1829)];

Nango-Imodani, Otsu-city, Shiga pref., In oak forest (Quercus serrata, Q.acutissina, etc.), [Jul,15,1971 (HONGO 4457); Jul,4,1973 (HONGO 4845); Jun,23,1976 (HONGO 5457)].

Natasho-mura, Fukui-pref., In deciduous forest, Jul,26,1965 (HONGO 3114).

This Inocybe belongs to subgenus Inocybe super-section Marginatae.

Inocybe chrysochroa is close to Inocybe mixtilis (Britzelmayr) Saccardo, of which is differs by shorter metuloids, paler wall of metuloids and abundant paracystidia.

ACKNOWLEDGMENT

The senior author is much indebted to Associate Professor K.Yokoyama, of Shiga University, for his encouragement during this study on Inocybe, to Dr. T.Hongo for examining the specimens of I.chrysochroa and for his kind suggestions, to Library of Tottori Mycological Institute for precious research data.

LITERATURE CITED

Hongo,T. - 1959 - The Agaricales of Japan I-(1), Mem. Fac. Lib. Arts Educ. Shiga Univ., Nat. Sci., 9:47- 94

Imai,S. - 1938 - Studies on the Agaricaceae of Hokkaido. 2., Journal of the Faculty of Agriculture Hokkaido Imperial University 43

Imai,S. - 1941 - Studia Agaricacearum Japonicarum. 3., The Botanical Magazine, 55:514-520

Kobayasi,Y. - 1952 - On the Genus Inocybe from Japan, Nagaoa 2: 76 -117

Kornerup,A. and Wanscher,J.H. - 1978 - Methuen Handbook of Color, 3rd ed., Eyre Methuen, London. 252pp.

Kuyper,T.W.- 1986 - A revision of the genus Inocybe in Europe I. Subgenus Inosperma and the smooth-spored species of subgenus Inocybe, Persoonia supplement 3:247pp.

MYCOTAXON

Volume XLVI, pp. 35-36 January-March 1993

RAMULARIA BISCUTELLAE, SP. NOV.

SIMEON G. VANEV
Institute of Botany, 1113 Sofia, Bulgaria

GAVRIL NEGREAN
Institute of biological Sciences, 77748 Bucharest, Rumania

ABSTRACT

Ramularia biscutellae, sp. nov. - a new species of genus Ramularia Unger parasiting on leaves of Biscutella laevigata L. in Rumania, is decribed and illustrated.

During taxonomic investigations of some undetermined Hyphomycetous specimens deposited in the Mycological Herbarium of the Institute of Biological Sciences, Bucharest, Rumania (BUCM), a new species of genus Ramularia Unger was established. In the present communication the new fungus is described and illustrated.

RAMULARIA BISCUTELLAE VANEV & NEGREAN, SP. NOV. (Fig. 1).

Maculae parvae (2-6 mm in diam.), amphigenae, orbiculares, brunneae. Caespituli amphigeni, pruinam albam punctatam vix conspicuam formantes. Conidiophora 12.5-80 X 2.5-4 µm, fasciculata, 1-2-cellularia, simplicia, recta vel geniculata, apice denticulata, hyalina. Conidia 12.5-35 X 3-4 µm, cylindrica vel fusiformia, 1-4 cellularia, recta vel leniter curvata, hyalina, catenulata.

In foliis vivis Biscutellae laevigatae L., Regio Harghita, Cheile Bicazului, Muntele Surduc, Romania, 23 Oct. 1986, leg. G. Negrean, BUCM 102 387 holotypus.

In speciebus Biscutellae Ramularia primum describitur.

Leaf spots small (2-6 mm in diam.), almost circular, brown. Caespituli amphigenous, not dense, whitish. Conidiophores 12.5 X 80 X 2.5-4 µm, aggregate in fascicles, unbranched, 1-2-celled, hyaline, straight or geniculate, with conidial scars in the apical part. Conidia 12.5-35 X 3-4 µm, cylindrical or fusiform, 1-4-celled, straight or slightly curved, hyaline, single or catenulate.

Specimen examined: on living leaves of Biscutella laevigata L., Distr. Harghita, Cheile Bicazului, Muntele Surduc, 23 Oct. 1986, G. Negrean, BUCM 102 387 holotype.

This is the first observation of Ramularia on species of genus Biscutella.

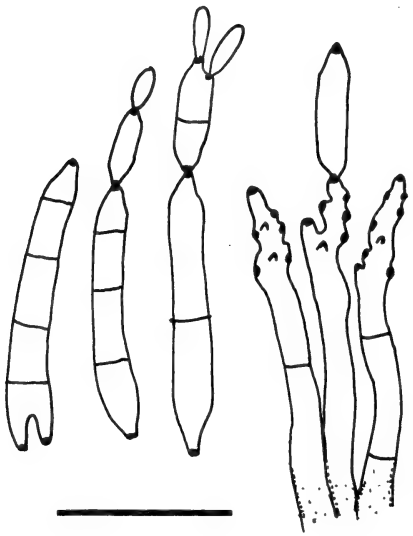


Fig. 1. Conidiophores and conidia of Ramularia biscutellae. Scale bar=20 µm.

MYCOTAXON

Volume XLVI, pp. 37-40 January-March 1993

HYPHODERMA ETRURIAE SP.NOV. (CORTICIACEAE, BASIDIOMYCETES) FROM THE NATURAL RESERVE OF BURANO, ITALY

ANNAROSA BERNICCHIA

Istituto di Patologia Vegetale,
Università di Bologna, Via F. Re 8
40126 Bologna, Italia

Summary

A new corticioid species is described from Riserva di Burano, Southern Tuscany, Italy, Hyphoderma etruriae sp.nov. The species resembles H.orphanellum but differs in having, grandinioid hymenium, clampless hyphae, absence of the large capitate cystidia and presence of smaller capitate hyphal endings as well as slightly different spores.

Introduction

While investigating the mycological flora of the Natural Reserve of Burano (Grosseto), Italy, the author made some collections of an underscribed species of Hyphoderma. Because of the particular environmental conditions, the hot and dry climate, the productions of carpophores is restricted from the late autumn to the first winter. Up to now about 70 wood-inhabiting aphyllophoraceous fungi have been found , mainly collected in the Juniperus phoenicea L. and J.oxycedrus L. ssp. macrocarpa (S.et S.) Ball scrubs. Among them there are some new species recently published: Antrodia macrospora Bern. & De Dom., Vararia maremmana Bern., Bernicchia (1992), and some other species not yet determined or published.
The flora of wood-inhabiting fungi of Reserve of Burano will be treated in a later paper.

Hyphoderma etruriae Bernicchia sp.nov. Fig. 1

Carposomata annua, resupinata, paula, subtilia, byssoidea postea continua, pallide cremea, margine indistincto. Hymenium laeve saepius minute grandinioideum parvis granis diffusis, apice pilosis. Systema hypharum monomiticum: hyphae generativae hyalinae, efibulatae, tenuitunicatae, ramosae 1-4 um latae, intertextae, aliquando cum crystallis. Cystidia hyalina, saepe frequentia, tenuitunicata, capitata, singula aut propinqua, procurrentia, 40-60 um longa, 1,5-2 um lata ad apicem, 5 um lata ad basim, caput 2-5-5,5 um latum. Hyphae terminalibus partis cum crystallis adsunt. Basidia subcylindracea-clavata, tenuitunicata, sine fibula basali, 22-50 x 7-8 um, 4 sterigmatibus. Sterigmata procera, usque ad 4-5 um longa. Basidiosporae leves, tenuitunicatae, cylindraceae-subellipsoides, non-amyloides, oleosa cum materia continentes, 8,5-10,5(-11) um longae, 5,5-6,5 um latae.

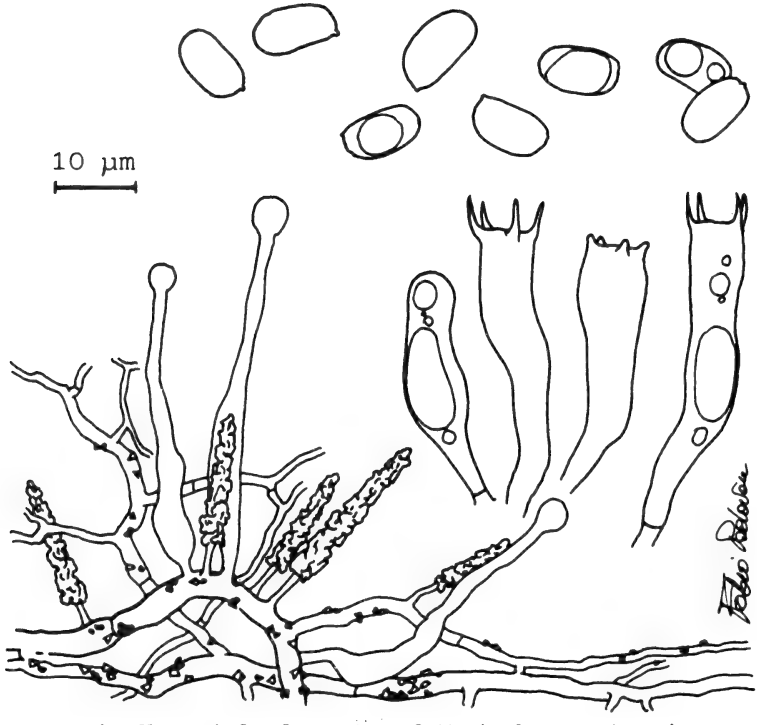


Figure n. 1: Hymenial elements of Hyphoderma etruriae.

Holotypus: Riserva di Burano (Grosseto) in vivi trunci cavo Juniperi pheniceae L. 29.02.90, coll. A. Bernicchia n. 5665 (Herb.Universitatis Bononiensis).

Etymology: from the collecting Tuscany (lat. Etruria).

Basidiocarp resupinate, small, adnate, byssoid then continuous, thin. Hymenium cream color, grandinioid with small sparse granules, sometimes pilose under the lens (50x) by projecting small cystidia; margin thin, indeterminate. Hyphal system monomitic: hyphae hyaline, narrow, thin-walled, branched and irregurarly interwoven, sparsely incrusted, 1-4 um diam.

Cystidia capitate (may be interpreted as capitate hyphal endings), widening toward the base, sometimes few or rare, single or in groups, thin-walled with homogeneous contents 40-60x5 um in the basal part and 1,5-2 um in the apical part; apical rounded head 2,5-5,5 um. In the hymenium and subhymenium there are numerous encrusted hyphal ends, yellowish with KOH, with a short and thin peduncle.

Basidia subcylindrical-clavate, without a basal clamp, with oily content, 4 sterigmata, 22-50 x 7-8 um. Sterigmata slender, 4-5 um.

Basidiospores cylindrical-ellipsoid, smooth, thin-walled, with a large oil drop, IKI$^-$, 8,5-10,5 (-11) x 5,5-6,5 um. Basidia and spores appear yellowish with KOH.

Habitat : The species grows in a hollow caused by an old wound, on dead wood of a living Juniperus phoenicea.

Distribution : collected only in the dune area of Riserva di Burano, from the late autumn to the spring.

Specimens examined: coll. 5665 on J.phoenicea 29.02.90 (Holotype); coll. 5412 on J.phoenicea 5.XI.91; coll. 5413 on J.phoenicea 5.XI.91; coll. 5666 on J.phoenicea 20.XII.91; coll. 5664 on J.Phoenicea 14.04.92 (sterile).

Remarks: According to N.Hallenber (pers.comm.) H.etruriae is similar to H.orphanellum: both have the same hyphal texture. Our species differs mainly by the grandinioid hymenium, the clampless hyphae, the absence of the large capitate cystidia and by the presence of smaller capitate hyphal endings (cystidia?) as well as slightly different spores. The encrusted hyphal tips are somewhat different, basidia and spores moreover appear yellowish with KOH.

Both species are deviating from other species of Hyphoderma and seem to constitute a group of their own.

Acknowledgment

I would like to express my special appreciation to Dr. N. Hallenberg, University of Göteborg, for his help, suggestions and for reviewing the manuscript. I am grateful to Dr. F. Padovan who has contributed the illustration.

References

BERNICCHIA A. 1992. Some new or rare Basidiomycetes (Aphyllophorales) from Italy. Mycotaxon XLIII, 317-326.
ERIKSSON J. and RYVARDEN L. 1975. Corticiaceae of North Europe, Vol. 3 Fungiflora, Oslo, 288-546.

MYCOTAXON

Volume XLVI, pp. 41-43 January-March 1993

DISCOSIA ARXII, SP. NOV.

SIMEON G. VANEV

Institute of Botany, 1113 Sofia, Bulgaria

ABSTRACT

Discosia arxii, sp. nov. - a new species of genus Discosia (Section Strobilina) on dead leaves of Fraxinus americana L. in Italy is described and illustrated.

Examinations of herbarium specimens received from the Museum of Natural History, Wien (W) and from the Institute of Biological Sciences, Bucharest (BUCM) revealed an undescribed species of genus Discosia. The fungus belonging to Section Strobilina Vanev (Vanev, 1991) is described, illustrated and compared with the other saprophytic species of this section.

DISCOSIA ARXII VANEV, SP. NOV. (Fig. 1).

Conidiomata pycnidialia 75-225 µm in diam., amphygena, solitaria, sparsa vel gregaria, rotundata, globoso-complanata vel discoidea, ostiolata, nigra; ostiolis 12-40 µm in diam., centralis vel excentricis, rotundatis vel plus minusve angularis, leniter elevatis, cellulis parvis intensius coloratis cincto. Cellulae conidiogenae 8-15 X 1.5-3 µm, cylindricae, rectae vel leniter curvatae, hyalinae. Conidia 11.3-15 ($\bar{x}$=13.04±1.16) X 2-2.5 ($\bar{x}$=2.26± 0.20) µm, holoblastica, cylindracea vel ellipsoidea, utrinque angustata, apice rotundata, basi truncata, recta vel leniter curvata, dorsiventralia, biappendiculata, 3-septata, subhyalina, semper longior cellula media vicina basis, quam cellula media vicina apices; appendices filiformes, ventrales, hyalinae, proxime duo septa extrema

formantur.

In foliis dejectis Fraxini americanae L. in Horto botanico, Padova, Italia, Nov. 1874, P. Saccardo (sub Discosia artocreas (Tode) Fr.),W, holotypus, BUCM, isotypus.

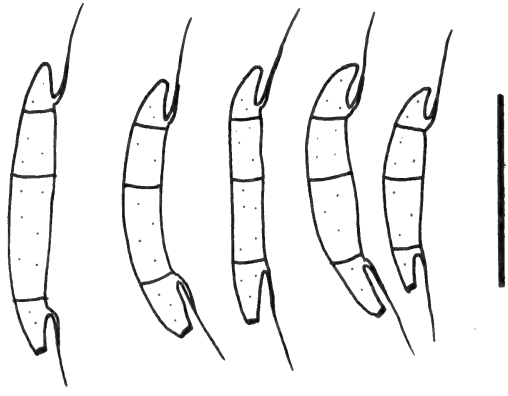


Fig. 1. Conidia of Discosia arxii.
Scale bar = 10 µm.

Conidiomata pycnidial 75-225 µm in diam., ostiolate, amphigenous, separate, gregarious or scattered, more or less circular, subcuticular, black, with thick stromatic fertile base and thin, brittle, sterile upper wall. Ostioles 12-40 µm in diam., central or eccentric, circular or irregular, slightly prominent, surrounded by darker cells. Conidiogenous cells 8-15 X 1.5-3 µm, cylindrical, straight or slightly curved, hyaline. Conidia 11.3-15 ($\bar{x}$=13.04± 1.16) X 2-2.5 ($\bar{x}$=2.26±0.20) µm, (length:width=5.76), cylindrical or ellipsoidal, tapered to the both ends, with a truncate base and an obtuse apex, straight or slightly dorsiventrally curved, 3-euseptate, subhyaline, the two middle cells unequal in length: the middle cell adjacent to the base always longer than the other middle cell, adjacent to the apex; conidial appendages hair-like, subapical and suprabasal, single, unbranched, arising just to the two end septa of the ventral side of the conidium.

D. arxii clearly differs from all other saprophytic species belonging to Section Strobilina in the size of conidia. Species in this section may be differentiated by the following key:

Key to the saprophytic species of Section Strobilina

1. Conidia 2-2.5 ($\bar{x}$=2.26) µm wide ..... D. arxii Vanev
   1*. Conidia more than 2.5 µm wide .....2.

2. Conidia 2.5-3 ($\bar{x}$=2.81) µm wide ..... D. strobilina Lib.
   2*. Conidia more than 3 µm wide ..... 3.

3. Conidia 10-13.8 ($\bar{x}$=12.45) µm long ... D. elliptica Fres.
   3*. Conidia more than 14 µm long ..... 4.

4. Conidia 15-18.8 ($\bar{x}$=16.61) µm long ... D. ocellata Berk. & Curt.
   4*. Conidia more than 21 µm long ..... 5.

5. Conidia 3-3.8 ($\bar{x}$=3.54) µm wide..... D. pleurochaeta Durieu & Mont.
   5*. Conidia 3.8-4.3 ($\bar{x}$=4.01) µm wide ..... D. smilacina De Not.

ACKNOWLEDGEMENTS

This research was carried out at the Centraalbureau voor Schimmelcultures, Baarn, The Netherlands and was supported financially from the International Agricultural Centre, Wageningen, The Netherlands. I wish to thank the Curators of W and BUCM for the loan of the specimens examined.

LITERATURE CITED

Vanev, S. G. 1991. Species conception and sections delimitation of genus Discosia. Mycotaxon 41:387-396.

MYCOTAXON

Volume XLVI, pp. 45-76 January-March 1993

REDISPOSITION OF SOME TAXA DESCRIBED BY J. B. ELLIS

MARGARET E. BARR

9475 Inverness Avenue, Sidney, British Columbia, Canada V8L 5G8

SUMMARY

A number of pyrenomycetous taxa described or transferred by Ellis and coworkers are dispersed to modern genera. Several synonymous names are noted under other species. A new genus *Jobellisia* is described to accommodate *Letendraea luteola* and *Herpotrichia nicaraguensis*. One new species *Acanthostigma filisporum* is proposed. The new name *Lasiosphaeria ellisii* replaces the later homonym *Sphaeria longispora* and *Phillipsiella ellisii* replaces the later homonym *Patellaria cyanea*. Additional new combinations are proposed for 31 species.

A listing of the pyrenomycetes described or transferred to other genera by J. B. Ellis and his coworkers is being prepared by Barr, Huhndorf, and Rogerson, in commemoration of the 1892 publication of *North American Pyrenomycetes*. A number of species that I have studied over the years require transfer to modern genera. In addition to some recently published articles (Barr 1989, 1990a, 1990b, 1990c, 1991a, 1991b, 1992a), an article in press (Barr 1992b) deals with species in the Lophiostomataceae and contains some of the needed combinations. Changes in position of several other fungi are proposed here. The new names are arranged alphabetically in ordinal and family sequence according to Barr (1987b, 1990b) and unpublished emendations.

HYMENOASCOMYCETES

Sordariales

Lasiosphaeriaceae

Cercophora spinosa (Harkness) Barr, comb. nov. Fig. 1a-c

Rosellinia spinosa Harkness, Bull. California Acad.

Sci. 1: 42. 1884.

Acanthostigma spinosum (Harkness) Ellis & Everh. N. Amer. Pyrenomyc. 156. 1892.

Ascomata superficial, scattered, globose, 180-280 µm diam; apex obtuse, ostiole inconspicuous; peridium brown externally, two or three rows of large pseudoparenchymatous cells, 10-12 µm wide, pallid internally, compressed rows of cells, 10-12 µm wide; setae over apex, yellowish, thick walled, ends obtuse, 50-120 µm long, 10-14 µm wide at base; sparse yellowish hyphae from base. Asci 55-68 x 8-10 µm, oblong, unitunicate; apex slightly thickened, nonamyloid. Ascospores 11-12 x 5.5-6.5 µm, upper cell dark brown, lower cell hyaline or yellowish, obovoid, 1-septate submedian, lower cell ca. 1/2 length of upper; wall smooth, germ pore variable in position in brown cell; globules in brown cell; obliquely uniseriate in the ascus.

On periderm of *Eucalyptus globulus* Labill. California: San Francisco, Cemetery, Sep 1881, H. W. Harkness 2842, holotype (CAS now UC).

This small *Cercophora* has nonappendaged ascospores that are most similar to but smaller than those of *C. solaris* (Cooke & Ellis) R. & O. Hilber (R. Hilber and O. Hilber 1979). The thick-walled appendages on the ascomata are comparable to those of *Lasiosphaeria munkii* R. & O. Hilber (O. Hilber et al. 1987).

Chaetosphaeria atriella (Cooke & Ellis) Barr, comb. nov. Fig. 1d,e

Sphaeria atriella Cooke & Ellis, Grevillea 6: 94. 1878.

Zignoella atriella (Cooke & Ellis) Sacc. Michelia 1: 346. 1878.

Psilosphaeria atriella (Cooke & Ellis) Cooke, Grevillea 16: 51. 1887.

Ascomata superficial, gregarious, ovoid, 220-275 µm wide, 330-385 µm high; apex short papillate, ostiole periphysate; peridium dark reddish brown, 20-30 µm wide, rows of compressed cells; surface roughened by protruding short hyphae (perhaps remnants of conidiophores). Asci 80-120 x 10-12 µm, cylindric, short stipitate, unitunicate; apical ring narrow, nonamyloid. Paraphyses remnants delicate, 1-2 µm wide. Ascospores 23-32 x 4-5 µm, hyaline to yellowish, oblong, ends obtuse, 3-(5-)septate, slightly constricted at median, first-formed septum; wall smooth; guttulate; overlapping biseriate in the ascus.

On decorticated wood of *Acer*, New Jersey: Newfield, holotype (K) (not seen). Additional collections: New Jersey: Newfield, "on bare dead limb lying partly in the water," 17 May 1877, J. B. Ellis 2457 (possible isotype); N.A.F. 783, *Kalmia latifolia* L. New Jersey: Newfield, Oct 1879, J. B. Ellis (NY).

Ellis and Everhart (1892) consigned this taxon to synonymy under *Acanthostigma decastylum* (Cooke) Sacc., a species with somewhat collabent, setose ascomata that may

well belong in *Lasiosphaeria*. *Chaetosphaeria atriella* seems most closely allied to *C. pulviscula* (Currey) Booth (Booth 1957), and has somewhat longer ascospores. One could expect to find an anamorph in *Menispora* in this taxon also.

Chaetosphaeria barbicincta (Ellis & Everh.) Barr, comb. nov.

Byssosphaeria barbicincta Ellis & Everh. J. Mycol. 4: 63. 1888.

Trichosphaeria barbicincta (Ellis & Everh.) Sacc. Syll. Fung. 9: 603. 1891.

Herpotrichia barbicincta (Ellis & Everh.) Ellis & Everh. N. Amer. Pyrenomyc. 158. 1892.

Niesslia barbicincta (Ellis & Everh.) Barr in Bigelow & Barr, Rhodora 65: 305. 1963.

On old periderm of *Magnolia*. New Jersey: Newfield, 25 Oct 1887, J. B. Ellis, holotype; N.A.F. 1958, isotype (NY).

Barr in Bigelow and Barr (1963) redescribed this species under *Niesslia*, from old periderm and wood, as well as dead leaves of *Vaccinium*. It differs from species of *Niesslia* (Hypocreales) in centrum structure. The glabrous, noncollabent ascomata are seated in a thin subiculum that produces conidiophores closely around the ascomata. Fresh material on *Vaccinium macrocarpon* Aiton (Massachusetts: Ruggles Pond, 13 Oct 1967, M. E. Barr 5088, NY) bore a *Codinaea* anamorph whose hyaline, one-celled conidia measure 14-17 x 1.5-2 µm. *Chaetosphaeria barbicincta* is close to *C. callimorpha* (Mont.) Sacc., has slightly smaller ascospores, and differs in habit.

Iodosphaeria arundinariae (Ellis & Everh.) Barr, comb. nov. Fig. 1f,g

Trichosphaeria arundinariae Ellis & Everh. N. Amer. Pyrenomyc. 153. 1892.

Ascomata superficial, gregarious in brown subiculum, globose to ovoid, 220-275 µm wide, 330-355 µm high; apex stoutly papillate, ostiole periphysate; peridium brown, small pseudoparenchymatous cells bearing septate hyphal appendages similar to and merging with hyphae of subiculum. Asci p.sp. 100-110 x 8-10 µm, stipe 20-30 µm long, cylindric, unitunicate; apical ring narrow, non-amyloid. Paraphyses sparse. Ascospores 18-20 x 6-7.5 µm, hyaline, ellipsoid fusoid, one celled; wall finely verruculose at maturity; usually three globules; uniseriate in the ascus.

On old culm of *Arundinaria*. Louisiana: sine loc., Jul 1888, A. B. Langlois 1412, holotype (NY).

The papillate ascomata and ellipsoid fusoid ascospores separate this species from others in the genus (Samuels et al. 1987). No anamorph was found on the holotype collection.

Lasiosphaeria ellisii Barr, nom. nov. Fig. 1h, i

Sphaeria longispora Ellis, Bull. Torrey Bot. Club 6: 135. 1877, non Currey 1859 nec Karsten 1873.

Ophioceras longispora (Ellis) Sacc. Syll. Fung. 2: 360. 1883.

Ceratostomella longispora (Ellis) Cooke, Grevillea 17: 50. 1889.

Ascomata superficial, scattered, ovoid, ca. 220 µm wide, 275 µm high, often pinched in at sides when dry; apex obtuse, papilla minute, of short dark brown setae, up to 15 µm long; peridium bright brown, 12-16 µm wide, large pseudoparenchymatous cells. Asci 90-100 x 10-12 µm, stipe short, unitunicate; apical ring shallow, nonamyloid, chitinoid. Paraphyses remnants delicate. Ascospores 50-70 x 3-4 µm, hyaline, elongate, apex often obtuse, tapered to base, delicately 3-7-septate or more; wall smooth; guttulate; in fascicle in the ascus.

On branch of *Kalmia latifolia* on ground. New Jersey: Newfield, 20 Jul 1874, J. B. Ellis, holotype (NY).

A collection from New York: Clyde, Sep 1881, O. F. Cooke 119 (NY) is referrable to this species. Another collection in NY labelled in Ellis's hand *S. longispora* Ellis (on rotten maple, New Jersey: Newfield, 29 Jun 1882) also has well-developed short setae forming the papilla, large ascomata, peridium of thick-walled cells, the surface verrucose, and longer, 7-9-septate ascospores, 80-100 x 3-4 µm in longer asci, 100-120 x 10-13 µm. This taxon would require at least varietal separation when the complexities of the species in *Lasiosphaeria* having elongate ascospores are finally assorted.

Ellis and Everhart (1892) thought that *Sphaeria longispora* might be the same as *Sphaeria atriella* Cooke & Ellis and suggested that it too was a synonym of *Acanthostigma decastylum* (Cooke) Sacc. The latter taxon has setae over the peridium and 3-5-septate ascospores, 22-30 x 4-4.5 µm; it may be a species of *Lasiosphaeria* also. *Sphaeria atriella* is transferred to *Chaetosphaeria* in this article.

When Saccardo erected *Ophioceras* subgenus *Acerbia* (Syll. Fung. 11: 353. 1895) for *O. hyptidis* P. Henn., he thought perhaps that *O. longispora* could be related. Berlese (1899) tentatively placed Ellis's species as a synonym of *Acerbia bacillata* (Cooke) Sacc. That is a different fungus entirely, *Daruvedia bacillata* (Cooke) Dennis, and a member of the Clypeosphaeriaceae (Xylariales) according to my studies. *Acerbia* may well belong in the Lasiosphaeriaceae, and the species having elongate ascospores could be arranged there. On the other hand, many species accepted in *Lasiosphaeria* have somewhat elongate ascospores and there is precedent to arrange the present species in that genus, as Carroll and Munk (1964) did for *L. raciborskii* (Penzig & Sacc.) Carroll & Munk, and Rossman (1977) for three long-spored species.

Nitschkiaceae

Acanthonitschkea horrida (Ellis & Everh.) Barr, comb. nov. Fig. 1j-l

Trichosphaeria horrida Ellis & Everh. in C. L. Smith, Bull. Lab. Nat. Hist. State Univ. Iowa 2: 399. 1893.

Ascomata superficial, gregarious in compact subiculum, collabent, 660-715 µm or more wide, 440-495 µm high; apex rounded; peridium 60-70 µm wide, rows of large pseudoparenchymatous cells, blackened externally, brown internally, Munk pores in cell walls; surface setose, setae dark reddish brown, septate, 165-275 µm long, 10 µm wide at base, tapered to point, occasionally branched; Quellkörper conic, extending nearly to base, ca. 250 µm deep, 140 µm wide in upper regions. Asci p. sp. 30-35 x 8-9 µm, stipe 10-30 µm long, numerous, thin walled, unitunicate, 12-16-spored. Ascospores 7.5-10 x 2.5-3 µm, hyaline, fusoid, one celled or 1-septate; wall smooth, guttulate; overlapping bi- to triseriate in the ascus.

On bark. Nicaragua: Ometepe, 1893, C. L. Smith, Nicaraguan Fungi 93, holotype (NY).

This species is closest to *A. foveolata* (Berk. & Curtis ex Berk.) Nannf., of those described by Nannfeldt (1975). That species has smaller ascomata, smaller octosporous asci and shorter ascospores of similar shape.

Coniochaetaceae

Several Ellis species that belong in *Coniochaeta* may be referred as synonyms to other taxa, e.g., *Sphaeria ovalis* Ellis (Bull. Torrey Bot. Club 8: 125. 1881), *Sphaeria pholidigena* Ellis (Bull. Torrey Bot. Club 10: 54. 1883), *Rosellinia parasitica* Ellis & Everh. (Proc. Acad. Nat. Sci. Philadelphia 42: 227. 1890), *Rosellinia bigeloviae* Ellis & Everh. (Amer. Nat. 31: 341. 1897) and *Rosellinia subcompressa* Ellis & Everh. (Bull. Torrey Bot Club 24: 277. 1897) all agree with the concept of *Coniochaeta pulveracea* (Ehrenb.: Fr.) Munk (Munk 1957). This species is closely related to *C. velutina* (Fuckel) Cooke and both have ellipsoid ascospores. One species that differs from these in forming fusoid rather than ellipsoid ascospores must be transferred to *Coniochaeta*.

Coniochaeta arctespora (Cooke & Ellis) Barr, comb. nov. Fig. 1m-p

Sphaeria arctespora Cooke & Ellis, Grevillea 5: 93. 1877.

Rosellinia arctespora (Cooke & Ellis) Sacc. Syll. Fung. 1: 268. 1882.

Sphaeria xylariaespora Cooke & Ellis, Grevillea 6: 94. 1878.

Rosellinia xylariaespora (Cooke & Ellis) Sacc. Syll. Fung. 1: 272. 1882.

Coniochaeta xylariaespora (Cooke & Ellis) Cooke,

Grevillea 16: 16. 1887.

Ascomata superficial, gregarious, globose to ovoid, 150-192 µm wide, up to 220 µm high; apex obtuse, ostiole small, periphysate; peridium narrow, 10-20 µm wide, compressed rows of cells, surface setose, setae blackish brown, pointed, scattered, 10-25 µm long. Asci (40-)45-75 x 6-8 µm, oblong, unitunicate; apical ring shallow, nonamyloid. Paraphyses delicate. Ascospores 9-13 x 5-6 x 3-4 µm, brown, fusoid, compressed, one celled; wall smooth, germ slit straight, nearly full length; guttulate; uniseriate in the ascus.

On branches. New Jersey: *Andromeda*, Vineland, 12 Nov 1876, J. B. Ellis, isotype; *Azalea viscosa* = *Rhododendron viscosum* (L.) Torr., Nov 1878, J. B. Ellis; N.A.F. 594 (NY).

The narrow ascospores separate this species from all but *C. saccardoi* (Marchal) Cain where the ascospores are larger. Ellis and Everhart (1892) united *Sphaeria arctespora* and *S. xylarispora* under the earlier name in *Rosellinia*. P. Martin (1967) thought the taxon to be a synonym of *Coniochaeta (Helminthosphaeria) ligniaria* (Grev.) Massee, but that species has wider, ellipsoid ascospores.

Hypocreales

Niessliaceae

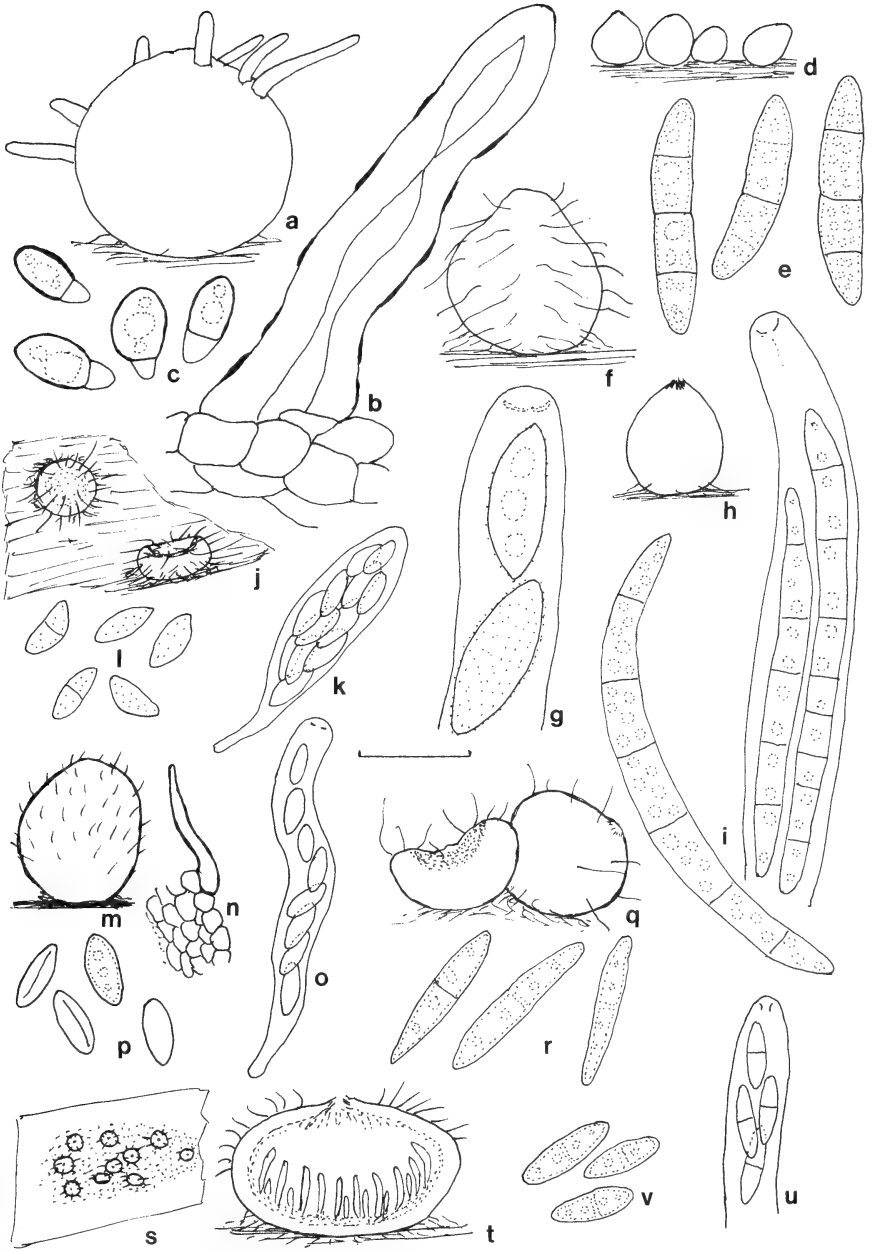
In a manuscript in preparation on this family, several names fall into synonymy; one Ellis and one Dearness name require new combinations to accommodate some of these synonyms.

Niesslia erysipheoides (Ellis & Everh.) Barr, comb. nov. Fig. 1q,r

Venturia erysipheoides Ellis & Everh. J. Mycol. 3: 128. 1887.

Venturia graminicola Ellis & Everh., nom.nud. in Barr, Canad. J. Bot. 46: 859. 1968.

Fig. 1. a-c. *Cercophora spinosa*, a, ascoma in outline, b, seta, c, ascospores. d,e. *Chaetosphaeria atriella*, d, habit of ascomata, e, ascospores. f,g. *Iodosphaeria arundinariae*, f, ascoma in outline, g, ascus apex and ascospores. h,i. *Lasiosphaeria ellisii*, h, ascoma in outline, i, ascus apex and ascospores. j-l. *Acanthonitschkea horrida*, j, habit of ascoma, k, ascus, l, ascospores. m-p. *Coniochaeta arctespora* m, ascoma in outline, n, seta and peridium cells, o, ascus, p, ascospores. q,r. *Niesslia erysipheoides*, q, ascomata in outline, r, ascospores. s-v. *Niesslia lanea*, s, habit of ascomata on hyphal weft, t, ascoma in vertical section, u, ascus apex, v. ascospores (s-u from holotype). Standard line = 150 µm for ascomata, 15 µm for asci, ascospores, setae. Habit sketches not to scale.


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v

Ascomata superficial, gregarious in thin brown subiculum, nearly globose, collabent, 150-200 µm wide, 90-120 µm high; apex obtuse, ostiole minute, periphysate; peridium brown, 10-13 µm wide, rows of small compressed cells; setose, setae scattered over peridium, blackish brown, 15-65 µm long. Asci 33-44 x 7.5-9 µm, oblong, unitunicate, 4-6-(8-)spored; apical ring narrow, nonamyloid. Ascospores 16.5-25 x 2-3 µm, hyaline, fusoid elongate, 1-septate; wall smooth; guttulate; in two overlapping fascicles in the ascus.

On dead culms of *Panicum curtisii* = *P. angustifolium* Elliott. Louisiana: Pointe à la Hache, 24 Feb 1887, A. B. Langlois, F. Ludov. 1023, 2 packets, holotype (NY).

This species has the longest ascospores of those that I recognize as North American species of *Niesslia*.

Niesslia exilis (Alb. & Schwein.: Fr.) Winter has as synonymous name *Venturia vaccinii* Ellis & Everh. (Proc. Acad. Nat. Sci. Philadelphia 46: 325. 1894; on dead leaves of *Vaccinium ovatum* Pursh, Washington: Seattle, Dec 1893, C. V. Piper 225, holotype, NY).

Niesslia exosporioides (Desm.) Winter has as synonymous name *Venturia sabalicola* Ellis & Everh. [Proc. Acad. Nat. Sci. Philadelphia 43: 233. 1891; on decaying leaves of *Sabal palmetto* (Walter) Schult. & J. H. Schult., Louisiana: Bayou Chene, 25 Oct 1888, A. B. Langlois, Fl. Ludov. 1546, holotype, NY].

Niesslia lanea (Dearness) Barr, comb. nov. Fig. 1s-v

Venturia lanea Dearness, Mycologia 18: 246. 1926.

Venturia barbula var. *foliicola* Ellis & Everh. N. Amer. Pyrenomyc. 141. 1892.

Venturia hispida Ellis, nom. nud. in Barr, Canad. J. Bot. 46: 854. 1968.

Holotype on *Chamaecyparis*, Washington: Upper White River, Sep 1924, J. M. Grant 6018 (Herb. Dearness 5730 in DAOM). On withered pine leaves on branches in fallen tree top. New Jersey: Newfield, Jan 1880, holotype of var. *foliicola*, N.A.F. 792; 18 Jan 1881, J. B. Ellis 821, holotype of var. *hispidula*; 15 Jan 1881, J. B. Ellis 325a as *V. hispida*; several packets of each (NY).

This species is comparable to *N. exilis*, but has larger ascomata [160-300(-330) vs. (65-)80-165 µm] and relatively wider ascospores [(7.5-)9-13.5 x 2-3.5 µm vs. (8-)10-15 x 1.5-2.5(-3) µm].

Niesslia pulchriseta (Peck) Barr in Barr et al. (1986) has as synonymous names: *Venturia parasitica* Ellis & Everh. (Proc. Acad. Nat. Sci. Philadelphia 42: 233. 1890; on old *Hypoxylon on Magnolia*, Louisiana: near St. Martinsville, 21 Jan 1889, A. B. Langlois, Fl. Ludov. 1781, holotype, NY); *Trichosphaeria flavida* Ellis & Everh. (N. Amer. Pyrenomyc. 152. 1892; on rotten wood, Ontario: London, J. Dearness and 18 Sep, J. Dearness, holotype, NY).; *Trichosphaeria cellaris* Ellis & Everh. ined. in Herb. (on bark of hickory barrel hoop in cellar, New

Jersey: Newfield, 9 Aug 1890, J. B. Ellis, NY).

Xylariales

Boliniaceae

Diatrype microspora Ellis (Bull. Torrey Bot. Club 8: 74. 1881) and var. *exutans* (Peck) Ellis & Everh. (N. Amer. Pyrenomyc. 582. 1892) are synonyms of *Camarops microspora* (Karsten) Shear.

Endoxyla luteobasis (Ellis) Barr, comb. nov. Fig. 2a-c

Sphaeria luteobasis Ellis, Bull. Torrey Bot. Club 6: 134. 1877.

Eutypa luteobasis (Ellis) Sacc. Syll. Fung. 1: 171. 1882.

Byssosphaeria luteobasis (Ellis) Cooke, Grevillea 15: 122. 1887.

Lasiosphaeria luteobasis (Ellis) Ellis & Everh. N. Amer. Pyrenomyc. 147. 1892.

Ascomata immersed erumpent, gregarious in yellowish, hyphal stroma, globose, up to 450 µm diam; beak short and wide, ca. 200 µm, apex blackened, ostiole periphysate; peridium externally yellowish brown, 45-70 µm wide, pseudoparenchymatous cells, internally yellowish to hyaline, 20 µm wide, compressed rows of cells; surrounded by yellowish brown or hyaline interwoven hyphae, 3.5-4 µm wide. Asci p.sp. 38.5-44 x 5.5-6.5 µm, stipe 27.5-44 µm long, peripheral, numerous; apical ring shallow if visible, nonamyloid. Paraphyses narrow. Ascospores 9-12 x 2-2.5 µm, brown, oblong allantoid, one celled or one septate; wall thin, smooth, minute pore at one end; guttulate; overlapping biseriate in upper part of ascus.

On *Quercus* wood. New Jersey: Newfield, J. B. Ellis, holotype; N.A.F. 99; Nov 1887, N.A.F. 1959 (NY).

Rappaz (1987) noted that this species belonged in *Endoxyla*, but he did not propose the combination. It differs from *E. operculata* (Alb. & Schwein.: Fr.) Fuckel by the conspicuous, yellowish stromatic tissues, by shorter beaks and narrower ascospores.

Endoxyla, excluding *Ceratostomella*, seems best disposed in the Boliniaceae (Rappaz, pers. comm.) The ascomata are immersed separately in wood or gregarious in a soft hyphal stroma. Short beaks are usually wide at the tips, rounded with an annular margin or sulcate. Asci have no visible apical ring or a shallow one and do not show the refractive pulvillus that is characteristic of members of the Clypeosphaeriaceae and *Ceratostomella*. The ascospores are brown, oblong to allantoid, one celled or delicately one septate and contain a germ pore in one end. *Sphaeria avocetta* Cooke & Ellis (Grevillea 8: 15. 1879) has recently been transferred to the genus (Romero and Samuels 1991).

Pseudovalsaria allantospora (Ellis & Everh.) Barr, comb. nov.

Valsaria allantospora Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 46:343. 1894.
Endoxylina allantospora (Ellis & Everh.) Shoemaker & Egger, F. Canad. 227. 1982.
Valsaria coloradensis Ellis & Everh. Amer. Nat. 32: 342. 1897.

Shoemaker and Egger (1982) redescribed and illustrated this species and compared it to *Endoxylina astroidea* (Fr.) Romell; in that species the main differences they noted were separately immersed ascomata beneath a blackened clypeal zone, asci having an narrow apical ring, and narrower, more truly allantoid ascospores. Rappaz (1987) transferred *Endoxylina astroidea* to *Eutypa* (Diatrypaceae) and *Valsaria allantospora* does not belong in that genus or family.

Pseudovalsaria was described to accommodate *P. foedans* (Karsten) Spooner (Spooner 1986), a species that is known on several woody plants in North America (e.g., *Diatrype moroides* Cooke & Peck, Barr et al. 1986) as well as Europe. Barr (1990b) inserted the genus in the Clypeosphaeriaceae, but with study of a European specimen contributed by J. Rappaz and consideration of his opinion on this taxon, it appears to be better arranged in the Boliniaceae. Ascospores are brown, one celled or one septate, have a terminal germ pore and measure (9-)10-13 x 3-5 µm. Rappaz (personal communication) suggested that *Pseudovalsaria* could be united with *Camarops*, but I prefer to retain two genera because of the larger, more heavily pigmented, often one-septate, not compressed ascospores in species of *Pseudovalsaria*. *Pseudovalsaria allantospora* is a species that is similar in most features to *P. foedans* but deviates by the formation of a blackened marginal zone surrounding the light yellowish-brown pseudostroma that contains the grouped ascomata. Ascospores are similar in shape, slightly longer, 11-16.5(-20) x 3.5-5.5 µm, and have thin regions at both ends.

Amphisphaeriaceae

Amphisphaeria multipunctata (Fuckel) Petrak has as additional synonym *Didymella corylina* Ellis & Everh. (Bull. Torrey Bot. Club 25: 504. 1898; on *Corylus*, Ontario: London, J. Dearness 2638, holotype, NY) and *Didymosphaeria major* Ellis & Everh. (Bull. Torrey Bot. Club 24: 130. 1897; *Rhus glabra*, Kansas: Rooks Co., 12 Sep 1895, E. Bartholomew 1934, holotype, NY). *Amphisphaeria pardalina* (Ellis. & Everh.) Barr and *A. andropogonis* (Ellis & Langlois) Barr were transferred to the genus earlier (Barr 1989).

The name *Discostroma corticola* (Fuckel) Brockmann is predated by *D. fuscella* (Berk. & Broome) Huhndorf (Huhndorf 1992a) and includes as a synonym *Sphaeria lejostega* Ellis (Bull. Torrey Bot. Club 8: 91. 1881).

Discostroma cupulum (Ellis) Barr, comb. nov. Fig. 2d,e

Sphaeria cupula Ellis, Amer. Nat. 17: 317. 1883; Bull. Torrey Bot. Club. 10: 90. 1883.

Didymosphaeria cupula (Ellis) Sacc. Syll. Fung. 9: 934. 1891.

Microthelia cupula (Ellis) Kuntze, Rev. Gen. Pl. 3: 493. 1898.

Amphisphaeria cupula (Ellis) Schrantz, Bull. Soc. Mycol. France 76: 334. 1960.

Cainia cupula (Ellis) Müller in Müller & von Arx, Beitr. Kryptogamenfl. Schweiz. 11(2): 706. 1962.

Sphaeria (Didymosphaeria) quercifolia Ellis, ined. in Herb.

Ascomata immersed in leaf tissues, gregarious, sphaeroid, 200-280 µm wide, 100-180 µm high; apex rounded, ostiole periphysate; peridium 11-20 µm wide, rows of compressed pallid cells at sides, blackened above and at base as clypeus. Asci 55-75 x 6-10 µm, cylindric, unitunicate; apical ring shallow, refractive, amyloid. Paraphyses narrow. Ascospores 10.5-13(-16.5) x 5-6.5 µm, hyaline becoming light yellowish brown to dull brown, ellipsoid, ends obtuse, often inequilateral, 1-septate, not or slightly constricted; wall smooth or finely verruculose as longitudinal striae; uniseriate in the ascus.

In dead, overwintered leaves still attached to broken branches of *Quercus coccinea* Muenchh. New Jersey: Newfield, 31 Mar 1882, J. B. Ellis, holotype (NY). Additional collections include the following, all from Newfield: Apr 1882 [as *Sphaeria (Didymosphaeria) quercifolia* ined.]; Apr 1882; N.A.F. 1338; Apr 1898, F. Col. 1320; *Castanea*, 4 Apr 1891 (on holotype of *Laestadia castanicola*) (NY).

The pigment and fine verruculae of the ascospores separate this species from *Sphaeria succinea* Roberge in Desm. (Ann. Sci. Nat. 3 ser., 10: 354. 1849), which is known from Europe and from a Californian collection. Müller's transfer to *Cainia* was based upon the presumed presence of germ pores terminally in the ascospores and on the presence of delicate long striations. The tips are slightly darker than the rest of the wall, but no pores are evident. Species of *Cainia* produce brown, larger, ellipsoid ascospores that bear several longitudinal germ slits (Krug 1977). Krug pointed out that these slits differed from the verruculose striae on ascospores of *C. cupula* and did not accept this species in the genus. He suggested disposition in *Amphisphaeria* but *Discostroma* is a more suitable genus; the species is related to *D. tostum* (Berk. & Broome) Brockmann.

Under *Discostroma massarina* (Sacc.) v. Arx is included *Homostegia kelseyi* Ellis & Everh. (Proc. Acad. Nat. Sci. Philadelphia 42: 248. 1890; *Ribes rotundifolia*, Montana: Helena, 23 Jan 1889, F. D. Kelsey 80/3; F. W.

Anderson 398, syntypes, NY).

Discostroma muricatum (Ellis & Everh.) Barr was added to the genus (Barr 1983).

Discostroma rubicola (Ellis & Everh.) Barr, comb. nov. Fig. 2f,g

Metasphaeria rubicola Ellis & Everh. Bull. Torrey Bot. Club 24: 279. 1897.

Ascomata immersed erumpent, separate or gregarious in rows, sphaeroid, 300-550 µm wide, 250-495 µm high; apex papillate, ostiole periphysate; peridium brown to pallid below, blackened above, 25-30 µm wide, compressed rows of cells, hyphae from sides into substrate. Asci 100-160 x 9-13 µm, cylindric, unitunicate; apical ring shallow, amyloid, pulvillus small, chitinoid. Paraphyses rather wide, thin walled. Ascospores 15.5-24 x 6.5-9 µm, hyaline, oblong, ends rounded, (1-2-)3-(4-)septate, slightly constricted; wall thick, smooth; guttulate; uniseriate in the ascus.

Associated anamorph acervular, somewhat overmature; conidia detached and conidiogenus cells not seen; conidia 22-30 x 9-10(-12) µm, yellowish brown or clear brown, paler toward base often, obovoid, rounded above, tapered to truncate base, 3-distoseptate, wall smooth, thick.

In canes of *Rubus deliciosus* Torr. Colorado: Deansbury, Apr 1897, E. Bethel, holotype; N.A.F. 3525 isotype (NY). The species is known from other species of *Rubus* in other localities: Canada: British Columbia: Sidney, 11 Feb 1991, M. E. Barr 7427, 15 Jan 1992, M. E. Barr 7938 (DAOM); USA: Arizona: Pima Co., Bear Wallow, Santa Catalina Mts., 2 Aug 1980, M. E. Barr 6789 (NY).

Discostroma rubicola is close to *D. massarina*, but has slightly smaller ascospores that form fewer septa. The associated anamorph is more in accord with that of *D. corticola than that of D. massarina*.

Lepteutypa alpestris (Ellis & Everh.) Barr, comb. nov. Fig. 2h

Melanomma alpestre Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 46: 328. 1895.

Stromata pulvinate, erumpent superficial, 1-1.5 mm wide, stromatic tissues dark reddish brown, pseudoparenchymatous cells, sometimes lacking at base; ascomata one to three together, globose, 440-550 µm diam; apex to surface, ostiole periphysate; peridium reddish brown, 15-20 µm wide, compressed rows of cells, internally hyaline, up to 20 µm wide. Asci 100-110 x 7.5-15 µm, cylindric or oblong, unitunicate; apical ring shallow, amyloid. Paraphyses narrow. Ascospores 20-27 x 5-7.5 µm, reddish brown, oblong or ellipsoid, slight taper to ends, often inequilateral or slightly curved, 3-septate, septa narrow; wall thick, smooth, surrounded by narrow hyaline coating; granular; uniseriate in the ascus.

In twigs of *Arctostaphylos nevadensis* A. Gray.

Washington: Mt. Paddo, Jul 1886, W. N. Suksdorf 268, holotype; Fl. Washington 342, isotype (NY).

The ascospores have narrow septa whereas their wall is wide, smooth and surrounded by a firm, narrow, hyaline coating. In sizes, this species is close to *L. cupressi* (Nattrass, Booth & Sutton) Swart.

Lepteutypa sabalicola (Ellis & G. Martin) Barr, comb. nov. Fig. 2i,j

Sphaeria sabalicola Ellis & G. Martin, Amer. Nat. 16: 810. 1892.

Leptosphaeria sabalicola (Ellis & G. Martin) Sacc. (as Ellis & G. Martin) Syll. Fung. 2: LVII. 1883.

Heptameria sabalicola (Ellis & G. Martin) Cooke, Grevillea 18: 32. 1889.

Ascomata immersed in yellowish areas of substrate, gregarious or separate under blackened clypei, sphaeroid, 260-495 µm wide, 130-275 µm high; apex papillate, opening to surface, ostiole periphysate; peridium brown, 10-20 µm wide, compressed rows of cells, darkened and thickened above as clypeus, brown hyphae from sides into substrate surrounding vascular bundles. Asci 44-65 x 7.5-10 µm, clavate cylindric, unitunicate; apical ring scarcely visible, nonamyloid. Paraphyses narrow, inspersed with granules. Ascospores 11-15.5 x 3.5-4.5 µm, reddish brown, ellipsoid, oblong or somewhat obovoid, (0-1-2-)3-septate, slightly constricted at first-formed septum; wall verruculose beneath outer firm layer; one globule per cell; uniseriate or partily biseriate above in the ascus.

In *Sabal serrulata* = *Serenoa serrulata* (Michx.) G. Nicholson. Florida: sine loc., winter 1882, G. Martin 3678, holotype (NY). Specimens in N.A.F. 1963 (Florida, 1887, W. W. Calkins) that were examined are overmature.

The ascomata are usually gregarious beneath a conspicuous blackened clypeus. Ascospores are verruculose under the narrow hyaline coating. Another collection from Florida, on *Aralia spinosa* L. (Horticultural Farm, Univ. Florida, Gainesville, 10 Aug 1985, M. E. Barr 7073, NY) is identical in asci and ascospores, but the ascomata form beaks that protrude 330-440 µm beyond the blackened clypeus.

Lepteutypa ulmicola (Ellis & Everh.) Barr, comb. nov. Fig. 2k

Clypeosphaeria ulmicola Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 45: 138. 1894.

Ascomata immersed, separate or gregarious, sphaeroid, 325-455 µm wide, (175-)300-350 µm high; apex papillate, ostiole periphysate; peridium brown, 10-16 µm wide, compressed rows of cells, thickened and darkened above as clypeus, 50-60 µm wide. Asci 108-150 x 9-10.5 µm, cylindric, unitunicate; apical ring amyloid. Paraphyses 1.5-3 µm wide, guttulate. Ascospores 16.5-21(-28) x 7.5-9

um, light to dark brown, ellipsoid or oblong, ends obtuse, (0-1-)3-septate, constricted at first-formed septum; wall dark, thick, verruculose or punctate beneath outer firm hyaline to brownish coating, 1-1.5 µm wide; one globule per cell; uniseriate in the ascus.

In branches of *Ulmus americana* L. Canada: Ontario: London, May 1893, J. Dearness; N.A.F. 3023 (Dearness Herb. in DAOM, NY); Aug 1895, N.A.F. 3327 (NY).

The holotype (NY, not seen) was described from the same locality, collected in Apr 1892 and labelled J. Dearness 1776. Dearness had annotated his copy of N.A.F. 3023 with this number also. The ascospores may become strongly pigmented and the wall is irregularly roughened beneath the outer coating.

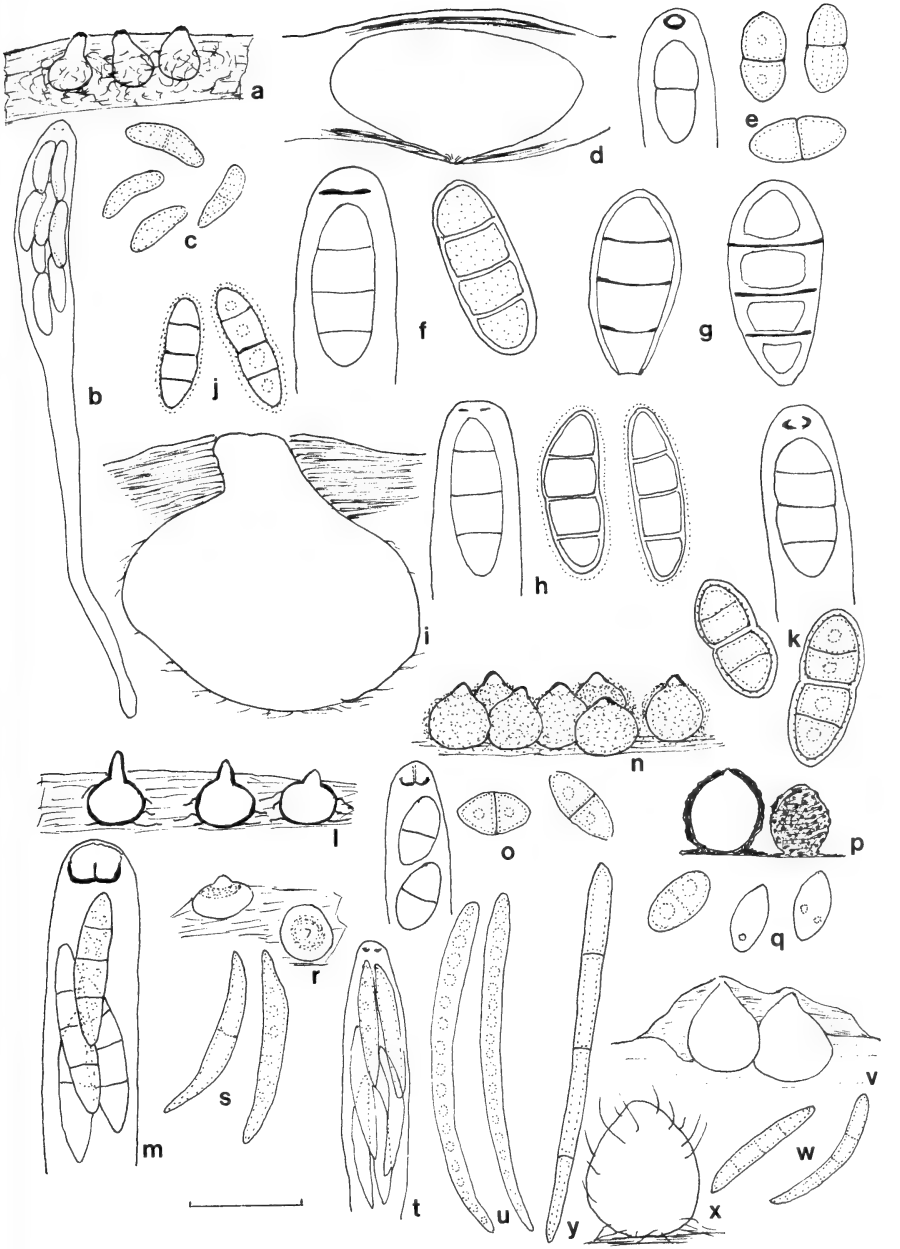
Thyridiaceae

According to Barr (1983) *Thyridium vestitum* (Fr.) Fuckel includes *Fenestella amorpha* Ellis & Everh. (J. Mycol. 4: 58. 1888; *Carya*, New York: Lyndonville, Apr 1888, C. E. Fairman, holotype, NY) and *F. ulmicola* Ellis & Everh. (Proc. Acad. Nat. Sci. Philadelphia 45: 143. 1893; *Ulmus americana*, Ontario: London, Aug 1892, J. Dearness, holotype, NY).

Didymosphaeria sphaerophora Ellis & Everh. (Bull. Torrey Bot. Club 22: 439. 1895; *Agave*, Mexico: Matamoras, Jun 1885, Dr. Egeling, holotype, NY) was transferred to *Valsaria* (Barr 1989).

The epithet *Valsonectria hypoxyloides* (Ellis & Everh.) Barr (Mycotaxon 39: 137. 1990) is predated by *V. cinnamomi* (Ces.) Huhndorf (Huhndorf 1992b).

Fig. 2. a-c. *Endoxyla luteobasis*, a, habit of ascomata, b, ascus, c, ascospores. d,e. *Discostroma cupulum*, d, ascoma in outline, clypei in both surfaces of leaf, e, ascus, apex tilted to show amyloid ring, and ascospores. f,g. *Discostroma rubicola*, f, ascus apex and ascospores, g, conidia. h. *Lepteutypa alpestris*, ascus apex and ascospores. i,j. *Lepteutypa sabalicola*, i, ascoma in outline, j, ascospores. k. *Lepteutypa ulmicola*, ascus apex and ascospores. l,m. *Ceratostomella conica*, l, habit of ascomata, m, ascus apex and ascospores. n,o. *Jobellisia luteola*, n, habit of ascomata, o, ascus apex and ascospores. p,q. *Jobellisia nicaraguensis*, p, habit of ascomata, one showing surface where crustose stroma was removed, q, ascospores. r-t. *Cresporhaphis rhoina*, r, habit of ascomata, s, ascospores, t. ascus apex and ascospores. u. *Linocarpon hamasporum*, ascospores. v,w. *Monographella fusariispora*, v, ascomata in outline under clypeus, w, ascospores. x,y. *Acanthostigma filisporum*, x, ascoma in outline, y, ascospore. Standard line = 150 µm for ascomata, 15 µm for asci, ascospores, conidia. Habit sketches not to scale.


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
y

Clypeosphaeriaceae

Taxa assigned to this family are most readily separated from those of the Amphisphaeriaceae by the clypeate, nearly globose ascomata and a well-developed pulvillus above a shallow or deep apical ring that is usually nonamyloid, rarely amyloid, in the cylindric asci. Immersed or emergent ascomata typically develop in old wood, rather than in or beneath periderm of branches or leaves and stems as they do in the Amphisphaeriaceae. As in members of the Amphisphaeriaceae, ascomata are typically immersed but may become erumpent to superficial, whereupon the clypeus may persist as a thickened papilla or beak, a stromatic coating around the peridium or rarely even form a subiculum and hyphal appendages.

Ceratostomella is recognized as separate from *Endoxyla* which is assigned to the Boliniaceae. Species of *Ceratostomella* are typically immersed in old wood and have an erumpent, thickened beak that tapers to the tip. Asci are cylindric clavate, usually stipitate and bear a refractive pulvillus above the narrow apical ring. Ascospores are hyaline, ellipsoid fusoid, one celled or delicately septate. Von Arx (1952) had included *Ceratostoma albocoronatum* Ellis (Amer. Nat. 17: 318. 1883) as one of numerous synonyms of *C. cirrhosa* (Pers.: Fr.) Sacc.

Ceratostomella conica (Ellis & Everh.) Barr, comb. nov. Fig. 21,m

Ceratostoma conicum Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 42: 226. 1890.

Ascomata immersed, gregarious, globose, 300-500 µm diam; beak 200 µm or longer, ostiole periphysate; peridium dark brown, 32-40 µm wide, compressed rows of cells, brown hyphae in wood near surface as thin clypeus. Asci 80-90 x 7-9 µm, cylindric, unitunicate; apical ring shallow, nonamyloid, pulvillus nearly as wide as apex, up to 5 µm high, chitinoid. Paraphyses narrow. Ascospores 15-20 x 3.5-4.5 µm, hyaline, fusoid, inequilateral, one celled then delicately (1-)3-(4-5-)septate; wall thin, smooth; guttulate; overlapping uni- to biseriate in the ascus.

In rotten pine logs. New Jersey: Newfield, Jul 1889, J. B. Ellis, holotype (NY); N.A.F. 2348, isotype; Nov 1892, N.A.F. 2921 (NY).

The narrower, more elongate fusoid ascospores separate this species from *C. cirrhosa*.

Jobellisia Barr, gen. nov.

Stromata crustosa cingens ascomata vel rostrata apicum. Ascomata immersa vel erumpentia superficialia gregaria globosa papillata vel rostrata. Asci unitunicati cylindrici paraphysati. Ascosporae brunneae ellipsoideae unicellularae vel uniseptatae, pori germinali terminali vel subterminali. Species typicus *Letendraea luteola*

Ellis & Everh.

A new genus is required to accommodate a group of species having brown, ellipsoid, one-celled or one-septate ascospores that usually contain terminal germ pores. Asci are typical of the Clypeosphaeriaceae and ascomata are gregarious or separate, papillate or beaked, immersed in or erumpent from the substrate. Stromatic tissues form a closely adhering crust around erumpent ascomata or beaks of immersed ascomata.

Jobellisia luteola (Ellis & Everh.) Barr, comb. nov.
Fig. 2n,o

Letendraea luteola Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 47: 415. 1895.

Ascomata closely gregarious, superficial, globose, 385-735 µm diam; apex light reddish, abruptly papillate, ostiole periphysate; peridium reddish brown, ca. 40-45 µm wide, compressed rows of cells, surrounded by layer of dull yellowish cells and granular matter, up to 30 µm wide. Asci p.sp. 45-80 x 5-7.5(-9) µm, stipe 20-40 µm long, cylindric, unitunicate; apical ring narrow, nonamyloid, pulvillus refractive, chitinoid, up to 3.5 µm high. Paraphyses narrow. Ascospores 9-12(-16) x 4-5(-6) µm, reddish brown, ellipsoid, straight or inequilateral, 1-septate; wall smooth, two terminal germ pores; one globule per cell; uniseriate in the ascus.

On rotten wood. Ohio: J. P. Morgan 1109, holotype (NY). Additional material of this species includes: as *L. luteola*?, *Populus* decorticated wood, Ontario: Lake Temagami, Temagami For. Reserve, 7 Aug 1931, H. S. Jackson & S. M. Pady, UT 2605 (BPI); as *L. luteola*, Iowa: Iowa City, 4 Jun 1936, G. W. Martin (slides FH, NY); as *Neopeckia diffusa*, old wood, New York: Old Forge, Adirondacks, 22 Aug 1934, R. F. Cain 3277 (GA 7883).

This fungus had been assigned to the Hypocreales because of bright pigmentation and soft texture (Seaver 1910), but an annotation by A. Rossman on the sheet bearing the holotype suggested that it could belong in the Amphisphaeriaceae. The globose ascomata and well developed pulvillus in the ascus are characteristics that indicate its position in the Clypeosphaeriaceae. *Letendraea* is a genus of bitunicate fungi in the Tubeufiaceae (Pleosporales) (Samuels 1973, Barr 1987b).

Jobellisia nicaraguensis (Ellis & Everh.) Barr, comb. nov.
Fig. 2p,q

Herpotrichia nicaraguensis Ellis & Everh. in C. L. Smith, Bull. Iowa Univ. Lab. Nat. Hist. 2: 400. 1893.

Ascomata gregarious, superficial on and surrounded by thin blackish, crustose stromatic tissues of dark brown, thick-walled pseudoparenchymatous cells; ascomata ovoid, 385-440 µm high, 330 µm wide; scarcely papillate; peridium dark brown externally, 30 µm wide, compressed rows of

cells, hyaline internally, up to 30 µm wide. Asci p.sp. 50-80 x 6-7 µm, stipe ca. 20 µm long, cylindric, unitunicate; apical ring narrow, nonamyloid, pulvillus refractive. Paraphyses numerous. Ascospores 10-12 x 4.5-5 µm, oblong ellipsoid, brownish, one celled or occasionally 1-septate; wall smooth, one or two minute germ pores terminal or subterminal; two globules; uniseriate in the ascus.

On rotten wood. Nicaragua: Ometepe, Lake Nicaragua, winter (Jan-Feb) 1893, B. Shimek, Nicaragua F. 77, holotype; Central Amer. F. C. L. Smith 8, isotype (NY).

The two packets are obviously parts of a single collection. The species deviates from *J. luteola* in denser, more deeply pigmented stromatic covering and in variable position of germ pores in the ascospores.

Hyponectriaceae

Species in *Exarmidium* were treated by Barr and Boise (1985). *Exarmidium morthieri* (Fuckel) Barr & Boise includes *Sphaeria soluta* Cooke & Ellis (Grevillea 5: 54. 1876) and *S. albocincta* Cooke & Ellis (Grevillea 7: 9. 1878). *Exarmidium diaphanum* (Cooke & Ellis) Barr & Boise includes *Sphaeria diaphana* Cooke & Ellis (Grevillea 5: 53. 1876). *Didymosphaeria catalina* Ellis & Everh. (Bull. Soc. California Acad. Sci. 4: 63. 1905) is an additional synonymous name (*Artemisia californica*, California: Catalina Island, Mar 1904, C. F. Baker 404, holotype; Avalon, 14 Mar 1904, Pacific Slope F. 4041, isotype, NY).

Leiosphaerella fusariospora (Ellis & Everh.) Barr, comb. nov. Fig. 2r,s

Sphaeria (Coelosphaeria) fusariospora Ellis & Everh. ined. N.A.F. 1957. 1888.

Coelosphaeria fusariospora Ellis & Everh. J. Mycol. 4: 65. 1888.

Leptosporella (?) fusariospora (Ellis & Everh.) v. Höhnel, Ann. Mycol. 16: 105. 1918.

Ascomata erumpent from periderm cells, separate, shining black, sphaeroid, collabent, 200-220 µm wide, 120 µm high; apex papillate, ostiole periphysate; peridium brown, 10-25 µm wide, compressed rows of cells, hyaline internally. Asci 40-60 x 7-9 µm, oblong, unitunicate; apical ring shallow, nonamyloid. Paraphyses narrow, in matrix. Ascospores (22-)24-45 x (1-)2-3.5 µm, hyaline, elongate fusoid, often slightly curved, one celled or 1-septate; wall smooth; guttulate; in two overlapping fascicles in the ascus.

On periderm of living *Populus* and *Celtis*. Kansas: sine loc. et dat., G. Egeling, comm. J. W. Eckfeldt, holotype; N.A.F. 1957, isotype; Rockport, Nov 1893, E. Bartholomew, N.A.F. 3016 (NY).

Leiosphaerella rhoina (Ellis & Everh.) Barr, comb. nov. Fig. 2t

globules. No appendages were found on ascospores of *L. hamasporum*.

Monographella fusariispora (Ellis & Everh.) Barr, comb. nov. Fig. 2v,w

Rhopographus fusariispora Ellis & Everh. Erythea 2: 23. 1894.

Exarmidium fusariispora (Ellis & Everh.) Theissen & Sydow, Ann. Mycol. 13: 424. 1915.

Clypei subepidermal, blackened, elongate elliptic, 1-3 mm long or longer by confluence, 385-440 µm wide, reddish brown, small pseudoparenchymatous cells, 20-30 µm wide; ascomata in single or double row beneath clypeus, sphaeroid, 165-220 µm wide, 137-165 µm high; apex short papillate, ostiole periphysate; peridium narrow, pallid to brownish, 12-20 µm wide, compressed rows of cells. Asci 45-66 x 8-9 µm, oblong, unitunicate; apical ring amyloid. Paraphyses narrow. Ascospores 20-32 x 3-3.5 µm, hyaline, fusoid, usually curved, ends acute, 1-2-3-septate; wall smooth; minutely guttulate; in two fascicles in the ascus.

In culms of *Panicum virgatum* L. Kansas: sine loc., 32 Mar 1893, E. Bartholomew, holotype, two packets, NY; Rooks Co., 5 May 1902, E. Bartholomew, F. Col. 1675 (NY).

In this species the darkened ellipsoid-fusoid clypeus may extend for several millimeters in culms and may cover several ascomata.

Trichosphaeriaceae

Acanthostigma perpusillum De Not., the type of that genus, is represented in North America by a collection bearing the unpublished name *Acanthostigma atrobarbum* var. *piniolum* Ellis & Ever. (Ontario: Ottawa, 23 Jul 1897), with ascospores 20-35 x 2-3 µm, (1-)3-(5-)septate. It was found also on N.A.F. 186 of *Sphaeria barbirostris*. The fungus under another unpublished name differs in longer and narrower ascospores and is described below.

Acanthostigma filisporum Ellis & Everh. ex Barr, sp. nov. Fig. 2x,y

Ascomata superficialia globosa vel collabentia (80-)120-200 µm diametro, setae fuligineae 45-90 µm longae, ad apices acutae. Asci unitunicati oblongi 33-52 x 7.5-9 µm. Ascosporae (33-)42-48 x 1.5-2 µm hyalinae elongatae triseptatae fasciculatae. Holotypus in cortice interiore *Mali*, "Newfield, New Jersey, 8 Dec 1889" a J. B. Ellis lecti in Herb. NY depositus.

Ascomata separate to gregarious, superficial, black, globose becoming somewhat collabent, (80-)120-200 µm diam; setae numerous, blackish brown, septate, tapered to pointed apex, 45-90 µm long; peridium narrow, ca. 22 µm wide. Asci 33-52 x 7.5-9 µm, oblong, unitunicate; apical ring not seen. Ascospores (33-)42-48 x 1.5-2 µm, hyaline, elongate, 3-septate, contents minutely guttulate, in a fascicle in the ascus.

Additional collection: Massachusetts: *Fraxinus*, Franklin Co., Conway, Baptist Hill, 16 Dec 1979, M. E. Barr 6648 (NY).

Three North American collections described under two specific epithets are closely related and are grouped together here under the earlier epithet. They strongly resemble *Cresporhaphis wienkampii* (Lahm ex Hazslin) Aguirre, the type of that genus (Aguirre-Hudson 1991), although the connection to an epiphloedal thallus is obscure and no conidiomata were observed. The collections have ascomata similar to those of *C. wienkampii*, the hymenial gel is light bluish in iodine, but asci are shorter and narrower, and the ascospore range is greater. This taxon occurs on wood or periderm of *Rhus, Populus,* and *Celtis* in North America, whereas *C. wienkampii* was described from *Salix, Robinia,* and *Quercus* in Europe.

Cresporhaphis rhoina (Ellis & Everh.) Barr, comb. nov.
Fig. 2r-t

Sphaeria (Winteria) rhoina Ellis & Everh. J. Mycol. 1: 92. 1885.

Winteria rhoina (Ellis & Everh.) Berlese & Voglino in Sacc. Syll. Fung. Addit. 1-4: 181. 1886.

Winterella rhoina (Ellis & Everh.) Berlese & Voglino in Sacc. Syll. Fung. 9: 910. 1891.

Leptosporella rhoina (Ellis & Everh.) v. Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 118: 1211. 1909.

Sphaeria (Coelosphaeria) fusariospora Ellis & Everh. ined. N.A.F. 1957. 1888.

Coelosphaeria fusariospora Ellis & Everh. J. Mycol. 4: 65. 1888.

Leptosporella (?) fusariospora (Ellis & Everh.) v. Höhnel, Ann. Mycol. 16: 105. 1918.

Ascomata erumpent from decorticated wood or periderm, separate to gregarious, dull or shining black, globose then collabent, 200-280 µm wide, 120-180 µm high; apex papillate, ostiole periphysate; peridium dark brown, 10-30 µm wide, cells isodiametric or compressed rows, hyaline internally. Asci 40-66 x 7-9 µm, oblong, short stipitate, unitunicate; apical ring shallow, nonamyloid. Paraphyses narrow, guttulate, in gel matrix, light bluish in iodine. Ascospores 20-30(-45) x (1-)2.5-3.5 µm, hyaline, elongate fusoid to falcate, one celled or delicately 1-septate; wall smooth; guttulate; in two or three overlapping fascicles in the ascus.

On wood and periderm of living or dead trees. Kansas: *Populus*, sine loc. et dat., G. Egeling, comm. J. W. Eckfeldt, holotype of *Sphaeria fusariospora*; N.A.F. 1957, isotype; *Celtis*, Rockport, Nov 1893, E. Bartholomew, N.A.F. 3016 (NY). New Jersey: *Rhus copallina* L., Newfield, May 1885, J. B. Ellis, holotype of *Sphaeria rhoina*; N.A.F. 1669, isotype (NY).

Franklin Co., Conway, Baptist Hill, 16 Dec 1979, M. E. Barr 6648 (NY).

LOCULOASCOMYCETES

Arthoniales
Arthoniaceae

Arthonia xylogena (Ellis & Everh.) Barr, comb. nov. Fig.3a,b

Dimerosporium xylogenum Ellis & Everh. J. Mycol. 2: 102. 1886.

Ascomata superficial, scattered, rounded in face view, pulvinate in side view, 150-200 µm wide, up to 150 µm high; peridium externally 10-12 µm wide, brown pseudoparenchymatous cells, surface irregular by protruding clumps of cells, internally and basally yellowish, more compressed rows of cells. Asci in one layer, separated by compressed rows of paraphysoids merging above as pseudoparenchymatous rows of cells, 27.5-38.5 x 20-24 µm, obovoid to subglobose, bitunicate. Ascospores 15.5-17.5 x 6-7 µm, yellowish hyaline, ellipsoid or somewhat obovoid, 1-septate; wall thin, smooth; guttulate; crowded in the ascus.

On decaying *Salix* wood. Louisiana: sine loc., 21 Feb 1886, A. B. Langlois 374, probable holotype (NY).

The combination into *Arthonia* is made with some diffidence, for this small fungus showed no thallus in the holotype specimen on old wood. Three similar packets bear the Herbarium name *Dimerosporium populi* Ellis & Everh. (nom. nud. in Kelsey, J. Mycol. 5: 81. 1889, from periderm of *Populus tremuloides*, Montana: Helena, 25 Mar 1889, F. D. Kelsey 213, NY). The rounded ascomata arise from a thin thallus; ascus and ascospore shapes are similar to those of *A. xylogena*; both are a little larger, 27.5-40 x 19-24.5 µm and 13-19 x 5-5.10 µm, respectively.

Phillipsiellaceae

Barr (1987a) proposed the combination *Johansonia cupulata* (Ellis & G. Martin) Barr for *Venturia cupulata* Ellis & G. Martin (Amer. Nat. 18: 69. 1884), a species having ascospores 9-13 x 3-4.5 µm. This fungus was collected on leaves of *Quercus laurifolia* Michx. (Florida: Green Cove Springs, 26 Mar 1883, G. Martin, N.A.F. 1298, isotype, NY). An unpublished name, *Venturia psilotricha* Ellis & G. Martin on *Gelseminum sempervirens* (L.) W.T. Aiton (Florida: Green Cove Springs, Feb 1884, G. Martin, NY) is scarcely different. Another taxon differs in larger ascospores and the following combination is proposed.

Johansonia formosa (Ellis & G. Martin) Barr, comb. nov. Fig. 3c

Venturia formosa Ellis & G. Martin, N. Amer.

Pyrenomyc. 139. 1892.

Ascomata superficial, scattered, rounded in face view, discoid in side view, 180-280 µm wide, 80-100 µm high, seated on and surrounded by delicate weft of light brown hyphae, hyphae bearing scattered brown, septate setae, 160-300 µm long; peridium at base pallid brown, at sides dark olivaceous, few rows of pseudoparenchymatous cells. Asci scattered in paraphysoids that form pseudoepithecium of digitate tips, asci 33-60 x 14.5-28 µm, short clavate, thick walled, bitunicate. Ascospores 21-25.5 x 7.5-9 µm, yellowish, obovoid, 1-septate; wall smooth; granular; crowded in the ascus.

On leaves of *Olea americana* = *Osmanthus americana* (L.) Benth. & J.D. Hook. Florida: Green Cove Springs, 15 Apr 1885, G. Martin, holotype (NY).

The same host plant bears *Plochmopeltis ellisii* v. Arx (von Arx 1959), a nonsetose species whose ascospores are smaller, 13-16 x 4-5 µm.

Phillipsiella ellisii Barr, nom. nov. Fig. 3d,e

Patellaria cyanea Ellis & G. Martin, J. Mycol. 1: 97. 1885, non Cooke 1880.

Patellea cyanea (Ellis & G. Martin) Sacc. Syll. Fung. 8: 784. 1889.

Ascomata superficial, scattered, hypophyllous, rounded in face view, discoid in side view, 275-385 µm wide, 65-110 µm high, seated on and surrounded by delicate weft of bluish hyphae, lacking setae; peridium at base light blue, at sides dark blue, interwoven hyphae in matrix. Asci parallel in paraphysoids that form a pseudoepithecium of rounded, dark blue, encrusted tips, asci 18-25 x 7.5-9 µm, short clavate, bitunicate. Ascospores 6-9 x 2-3 µm, hyaline, oblong to somewhat obovoid, 1-septate; wall smooth; homogeneous, crowded in the ascus.

On leaves of *Quercus (laurifolia.)* Florida: Green Cove Springs, Feb 1885, G. Martin, holotype; two isotypes ex Herb. Farlow; N.A.F. 1781 (NY).

The striking blue pigmentation of hyphae, peridium and pseudoepithecium sets this species apart from *P. atra* Cooke, which it otherwise resembles quite closely. On the N.A.F. collections the host was named as *Ilex coriacea*, but Cash (1954) corrected its identification and the holotype and isotype collections were correctly identified as *Quercus*.

Dothideales
Pseudosphaeriaceae

Monascostroma eckfeldtii (Ellis) Barr, comb. nov. Fig.3f,g

Sphaeria eckfeldtii Ellis, Bull. Torrey Bot. Club 8: 91. 1881.

Melanomma eckfeldtii (Ellis) Sacc. Syll. Fung. 2: 105. 1883.

Amphisphaeria eckfeldtii (Ellis) Cooke, Grevillea 16: 89. 1888.

Zignoella eckfeldtii (Ellis) Sacc. in Ellis, Cat. Pl. New Jersey 519. 1889.

Melanopsamma eckfeldtii (Ellis) Ellis & Everh. N. Amer. Pyrenomyc. 178. 1892.

Ascomata erumpent from wood fibers, gregarious, globose, 135-190 µm diam; apex rounded; peridium brown, ca. 15 µm wide, pseudoparenchymatous cells; surface bearing short, blunt, septate, brown hyphal appendages, 26-40 µm long, hyphae into substrate. Asci 48-65 x 23-32 µm, oblong, bitunicate, few. Cellular tissues present between and above asci. Ascospores 29-35 x 7.5-9 µm, yellowish, becoming dull brownish in age, fusoid oblong, 1-septate, not constricted; wall verruculose in age, no gel coating seen; guttulate, finally several globules; overlapping bi-to triseriate or crowded in the ascus.

In bleached wood of *Castanea*. Pennsylvania: near Philadelphia, Jan 1880, J. Eckfeldt, holotype; Ellis N.A.F. 593, isotype (NY).

This species poses problems in classification, evident by the disparate genera to which it has been assigned in the past. The centrum is pseudosphaeriaceous and asci and ascospores are quite in accord with the smaller ones of *M. innumerosa* (Desm.) v. Höhnel, even though the substrate is unusual for members of the genus.

Chaetothyriales
Chaetothyriaceae

Ceramothyrium martinii (Ellis & Sacc.) Barr, comb. nov. Fig. 3h,i

Saccardia martini Ellis & Sacc. Michelia 2: 373. 1881.

Phaeosaccardinula martini (Ellis & Sacc.) v. Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 124: 57. 1915.

Ascomata scattered, superficial, hypophyllous, on and beneath thin weft of brownish branching hyphae, collabent, 104-250 µm wide, 80-130 µm high; apex minutely papillate; peridium up to 12 µm wide, rows of small pseudoparenchymatous cells, surface covered by hyphal weft. Asci 37-60 x 15-20 µm, oblong, bitunicate, in gel matrix beneath short periphysoids. Ascospores 20-27(-30) x 7-9 µm, hyaline, oblong, ends obtuse or one end mucronate, 5-7-(9-)septate, longitudinal septum in one or two cells at times; wall thick, smooth; granular or guttulate; overlapping and crowded in the ascus.

Holotype not seen, presumably at PAD. Possible syntypes on leaves of *Quercus laurifolia*, Florida: Crescent City, Winter 1880, G. Martin (three packets), NY; Green Cove Springs, 1881, G. Martin, ex Farlow Herb., NY. Additional collections on *Quercus* include sine loc. et dat., G. Martin; N.A.F. 1289a; on *Magnolia glauca* = *M.*

virginiana L., N.A.F. 1289b; as var. *major* ined. N.A.F. 1289c (NY). The species was illustrated on *Quercus* (Ellis and Everhart 1892).

Because of the thin peridium, delicate hyphal weft and hyaline ascospores, this species appears better assigned to *Ceramothyrium* than to *Phaeosaccardinula*, even though some ascospores may show one or two longitudinal septa. The ascospores are mostly obtusely ended, similar to those of *C. carniolicum* (Rehm) Petrak rather than bearing the mucronate tips described for *C. linnaeae* (Dearness) Hughes (Constantinescu et al. 1989). No *Stanhughesia* anamorph has been observed for *C. martinii*.

Chaetothyrium berenice (Berk. & Curtis) Barr, comb. nov. Fig. j-l

Sphaeria berenice Berk. & Curtis, Grevillea 4: 108. 1876.

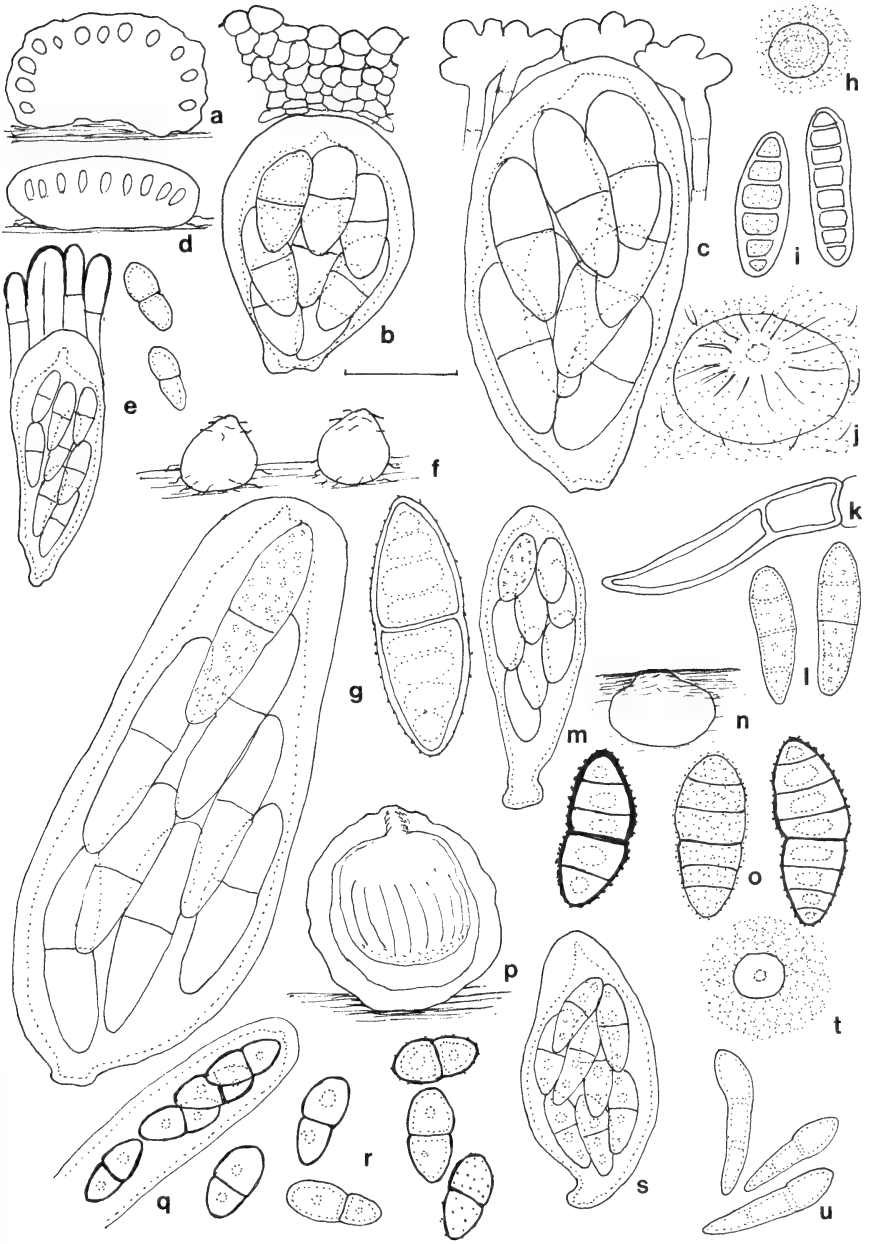
Acanthostigma berenice (Berk. & Curtis) Sacc. Syll. Fung. 2: 210. 1883.

Venturia saccardioides Ellis & G. Martin, Amer. Nat. 18: 69. 1884.

Acanthostigma saccardioides (Ellis & G. Martin) Sacc. Syll. Fung. 9: 854. 1891.

Ascomata scattered, hypophyllous, superficial on and in thin weft of brown hyphae, collabent, 100-150 µm wide, 80-100 µm high; apex minutely papillate; peridium narrow, light brown, pseudoparenchymatous cells; surface covered by hyphal weft bearing brown, usually septate setae, 55-100 x 5.5-9 µm. Asci 37.5-55 x 9-17.5 µm, oblong or saccate, in gel matrix beneath delicate periphysoids. Ascospores 11-20(-22) x 2.5-3.5(-5.5) µm, hyaline to yellowish, oblong to obovoid, ends obtuse, rarely mucronate, (1-)3-septate; wall thin, smooth; guttulate;

Fig. 3. a,b. *Arthonia xylogena*, a, outline of ascoma showing position of asci, b, ascus, ascospores and upper cellular layer. c. *Johansonia formosa*, ascus, ascospores and tips of paraphysoids. d,e. *Phillipsiella ellisii*, d, outline of ascoma showing position of asci, e, ascus, ascospores and tips of paraphysoids. f,g. *Monascostroma eckfeldtii*, f, habit of ascomata, g, ascus and ascospores. h,i. *Ceramothyrium martinii*, h, habit of ascoma, i, ascospores. j-l. *Chaetothyrium berenice*, j, outline of ascoma beneath setose hyphal weft, k, seta, l, ascospores. m. *Guignardia apocyni*, ascus and ascospores. n,o. *Chaetomastia scelesta*, n, habit of ascoma, o, ascospores. p-r. *Immotthia atrograna*, p, outline of ascoma showing basally wide peridium, q, ascus apex and ascospores (from *A. confertissima*), r, ascospores (left from *A. deformata*, right from *A. pilosella*). s. *Chaetothyrina applanata*, ascus and ascospores. t,u. *Micropeltis subcyanea*, t, habit of ascoma, u, ascospores. Standard line = 150 µm for ascomata, 15 µm for asci, ascospores, seta. Habit sketches not to scale.


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u

overlapping and crowded in the ascus.

On leaves of *Magnolia glauca* = *M. virginiana* L. Florida: Green Cove Springs, Mar 1883, G. Martin, holotype of *Venturia saccardioides*, two packets (NY). Also on holotype of *Venturia applanata*, 2 Mar 1883 (NY).

As in the material of *Ceramothyrium martinii*, the hyphae are lightly pigmented, contain one or two globules per cell, and are branched and anastomose. The darker setae develop on the hyphae and from peridum cells. Ellis and Everhart (1892) reduced *V. saccardioides* to synonymy under the Berkeley and Curtis name. That was described from *Magnolia macrophylla* Michx. Ellis and Everhart also noted specimens from Louisiana on *M. grandiflora* L.

Pleosporales

Botryosphaeriaceae

Guignardia Viala & Ravaz and *G. bidwellii* (Ellis) Viala & Ravaz have been proposed to be conserved (Hawksworth and David 1989) and the Committee for Fungi and Lichens (Gams 1992) has recommended acceptance. The genus was introduced to replace *Laestadia* Auersw. 1869, non Kunth ex Lessing 1832, and would thus be typified by *L. alnea* (Fr.) Auersw., which in turn is a species of *Plagiostoma* (Barr 1978). Bissett (1986) and Barr (1987b) utilized *Discochora* v. Höhnel for *Guignardia bidwellii* and related species but because of the numerous plant pathogens that are involved, the proposal to conserve *Guignardia* in this sense has much merit.

Guignardia apocyni (Ellis & Everh.) Barr, comb. nov. Fig.3m

Laestadia apocyni Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 42: 230. 1890.

Ascomata immersed, separate or gregarious, sphaeroid, 150-200 µm wide, 120-165 µm high; apex plane, small ostiole; peridium dark brown, narrow. Asci 40-52 x 9-14.5 µm, oblong, bitunicate. Pseudoparaphyses scanty. Ascospores 9.5-14.5 x 5-6.5 µm, hyaline, oblong to obovoid, usually tapered to base, inquilateral, one celled; wall thin, smooth; guttulate; overlapping bi- to triseriate in the ascus.

On stems of *Apocynum*. Ontario: London, Jun 1890, J. Dearness 1734, holotype (NY); isotype (Dearness Herb. in DAOM); N.A.F. 2540 (NY).

Leptosphaeriaceae

Didymolepta anomala (Ellis & Everh.) Barr, comb. nov.

Leptosphaeria anomala Ellis & Everh. J. Mycol. 3: 117. 1887.

Didymosphaeria anomala (Ellis & Everh.) Sacc. Syll. Fung. 9: 730. 1891.

Microthelia anomala (Ellis & Everh.) Kuntze, Rev. Gen. Pl. 3: 498. 1898.

Wettsteinina anomala (Ellis & Everh.) Barr, Contrib. Univ. Michigan Herb. 9: 548. 1972.

Didymella anomala (Ellis & Everh.) Shoemaker & Babcock, Canad. J. Bot. 65: 387. 1987.

The separation of species in *Didymolepta* from those in *Didymella* (Phaeosphaeriaceae) was justified by Barr (1987b, 1992a). As Ellis and Everhart noted when they described *L. anomala*, this species is leptosphaeroid in shape and consistency of ascomata; it fits well with others in *Didymolepta*. It was redescribed and illustrated by Shoemaker and Babcock (1987). The holotype specimen is on dead herbaceous stems (Utah Territory, Jun 1887, S. J. Harkness, NY).

Dacampiaceae

Chaetomastia scelesta (Cooke & Ellis) Barr, comb. nov. Fig. 3n,o

Lophiostoma scelestum Cooke & Ellis, Grevillea 6: 12. 1877, for *Lophiostoma microstoma* Cooke & Ellis, Grevillea 4: 179. 1872, non Niessl.

Navicella microstoma Kuntze, Rev. Gen. Pl. 3: 500. 1898.

Ascomata immersed, separate, ellipsoid, up to 1000 µm long, 550 µm wide and high; apex rounded with elongate, low, compressed papilla; peridium dark reddish brown, up to 50 µm wide, rows of small pseudoparenchymatous cells, hyphae in wood in upper regions. Asci 100-130 x 16-18 µm, clavate, bitunicate. Pseudoparaphyses narrowly cellular, numerous. Ascospores 21-26(-30) x 7-9 µm, dark reddish brown, oblong to obovoid, ends obtuse, often inequilateral, (3-)5-7-septate, slightly constricted at median or submedian, first-formed septum; wall dark, heavily verruculose; one globule per cell; biseriate in the ascus.

On old wood of *Acer*. New Jersey: Newfield, N.A.F. 96, F. Nova-Caes. 92, Spring 1876; fragment "one of the original slice", isotype; Feb 1880; *Viburnum*, no data; another packet, no data; Ohio: *Acer saccharum* Marsh., Morgan 1188 (NY).

Specimens on *Quercus and Malus* wood under this name are instead *Platystomum obtectum* Peck (Melanommatales, Barr 1990a). Ellis and Everhart (1892) added *Sphaeria pachyascus* Cooke & Ellis (Grevillea 4: 179. 1872) as a synonym, but the specimen F. Nova-Caes. 93 of *Sphaeria pachyascus* on *Quercus* (New Jersey: Newfield, 31 Jul 1876) while overmature is more like *P. obtectum*. The reddish brown, verruculose ascospores and the small-celled peridium of *C. scelesta* are not lophiostomataceous, even though the apex is somewhat elongate and compressed.

Immotthia atrograna (Cooke & Ellis) Barr, comb. nov. Fig.3p-r

Spnaeria atrograna Cooke & Ellis, Grevillea 8: 15. 1879.

Amphisphaeria atrograna (Cooke & Ellis) Sacc. Syll. Fung. 1: 722. 1882.
Gibbera atrograna (Cooke & Ellis) Sivanesan, Trans. Brit. Mycol. Soc. 65: 396. 1975.
Amphisphaeria deformata Ellis & Langlois, J. Mycol. 4: 123. 1888.
Amphisphaeria pilosella Ellis & Everh. Proc. Acad. Nat. Sci. Philadeophia 47: 418. 1895.
Gibbera pilosella (Ellis & Everh.) Sivanesan, Trans. Brit. Mycol. Soc. 65: 395. 1975.
Amphisphaeria confertissima Ellis & Everh. Proc. Acad. Nat. Sci. Phialdelphia 47: 418. 1895.
Gibbera confertissima (Ellis & Everh.) Sivanesan, Trans. Brit. Mycol. Soc. 65: 395. 1975.

Ascomata separate to densely gregarious, erumpent superficial from blackened stromatic crust, globose or nearly so, (130-)180-385 µm wide; apex rounded or short papillate, pore area pallid in surface view, ostiole periphysate; peridium soft, reddish brown, small pseudoparenchymatous cells, 20-40 µm wide at sides, base widened by rows of hyaline cells, 50-80 µm, occasionally base columnar; surface roughened with protruding cells. Asci 50-90 x 5-8(-10) µm, cylindric or oblong, bitunicate, (4-6-)8-spored. Pseudoparaphyses narrowly cellular. Ascospores 9-14(-16) x 4.5-6(-7) µm, clear brown or reddish brown, wall and septum darkened, obovoid, lower cell often shorter and narrower than upper, 1-septate, constricted; wall smooth or sparsely verruculose; one globule per cell; uniseriate or partially biseriate in the ascus.

In blackened crustose stromatic base on wood. The type specimen of *Sphaeria atrograna* in K, described from *Liquidambar* (New Jersey: Malaga, J. B. Ellis, Cooke 3179) was investigated by Sivanesan (1975); two isotypes are at NY, dated Sep 1878 and 14 Sep 1878. Other matching collections include the following. Louisiana: old cedar post, Pointe à la Hache, 21 Mar 1886, A. B. Langlois, Fl. Ludov. 1459, holotype of *Amphisphaeria deformata*; Massachusetts: *Tilia*, Franklin Co., Conway, Baptist Hill, 5 Nov 1978, M, E. Barr 6523; Ohio: wood, summer 1894, Morgan 1103, holotype of *A. pilosella*; wood, Morgan 1028, holotype of *A. confertissima*; Morgan 1039 (NY).

Despite minor variations, the specimens noted above are not separable into four species and are merged under the earliest name. Morgan 1039 bears pycnidial conidiomata identical to the ascomata, containing light reddish brown, one celled conidia, 7-8 x 3.5-4 µm. A collection from North Carolina (Macon Co., Ellicott Rock Trail, 14 Oct 1990, Y. Doi, A. Y. Rossman and G. J. Samuels, BPI) is close to *I. atrograna*, but is slightly smaller and the pallid ascospores measure 6-8(-9) x 2-3 µm. Pycnidial conidiomata are interspersed with ascomata; conidia are hyaline, one celled, 4-5 x 1 µm.

Coleroa pusiola (Karsten) Sivanesan may well be

another species in the genus, although the illustration of ascomata shows a thinner peridium (Sivanesan 1975). Ascospores are smaller than in *I. atrograna*.

Micropeltidaceae

Two species described under *Venturia* were excluded from that genus and were tentatively referred to *Chaetothyrina* (Barr 1968).

Chaetothyrina applanata (Ellis & G. Martin) Barr, comb. nov. Fig. 3s

Venturia applanata Ellis & G. Martin, Amer. Nat. 18: 69. 1884.

Ascomata superficial, hypophyllous, scattered, dimidiate scutate, up to 200 µm wide, apex with rounded pore; peridium blackish brown above, hyaline at base, small pseudoparenchymatous cells, in surface view approaching textura epidermoidea, extending on substrate as thin radiating pellicle, bearing scattered, dark brown, septate setae, 33-100 x 3.5-5.5 µm. Asci 33-38.5 x 11-14.5 µm, oblong saccate, bitunicate. Pseudoparaphyses narrowly cellular. Ascospores 10-13.5 x 3.5-5 µm, hyaline, obovoid, ends obtuse, 1-septate, not constricted; wall smooth; two globules per cell; crowded in the ascus.

On living leaves of *Magnolia glauca* = *M. virginiana*. Florida: Green Cove Springs, 12 Mar 1883, G. Martin, holotype (NY).

This fungus is similar to *C. asterinoides* (Ellis & G. Martin) Barr (Mycotaxon 29: 504. 1987; *Venturia asterinoides* Ellis & G. Martin, N. Amer. Pyrenomyc. 138. 18792). The latter was collected at the same time and locality on leaves of *Quercus laurifolia*. It has larger asci (38.5-46 x 13-16.5 µm) and ascospores (15.5-17.5 x 4.5-6 µm), in addition to the different host tree.

Micropeltis subcyanea (Ellis & G. Martin) Barr, comb. nov. Fig. 3t,u

Asterina subcyanea Ellis & G. Martin, Amer. Nat. 18: 1148. 1884.

Asterella subcyanea (Ellis & G. Martin) Sacc. Syll. Fung. 9: 395. 1891.

Microthyrium subcyaneum (Ellis & G. Martin) Theissen, Ann. Mycol. 10: 191. 1912.

Dictyothyrium subcyaneum (Ellis & G. Martin) Theissen, Oesterr. Bot. Z. 62: 278. 1912.

Ascomata superficial, hypophyllous, dimidiate scutate, 190-220 µm wide, apex with wide rounded pore, 65-80 µm; peridium bluish brown above, hyaline at base, approaching textura epidermoidea in surface view, extending as thin bluish pellicle of delicate hyphae. Asci 50-60 x 12-14 µm, oblong, bitunicate. Pseudoparaphyses narrowly cellular. Ascospores 15-21 x (2.5-)3.5-4.5 µm, hyaline, narrowly obovoid, tapering toward base, ends obtuse, 2-septate, not constricted; wall

(NY).

This fungus, closely related to species of *Chaetothyrina*, has more elongate, two-septate ascospores, lacks setae, and appears to be best assigned to *Micropeltis*.

ACKNOWLEDGMENTS

I acknowledge my indebtedness to the curators of herbaria cited above, in particular to Clark T. Rogerson, NY, for permission to examine specimens in their keeping. Sabine Huhndorf kindly reviewed the manuscript and provided additional information on some of the type specimens.

LITERATURE CITED

Aguirre-Hudson, B. 1991. A taxonomic study of the species referred to the ascomycete genus *Leptorhaphis*. Bull. Brit. Mus. Nat. Hist. (Botany) 21(2): 85-192.

Arx, J. A. von. 1952. Über die Ascomycetengattung *Ceratostomella* Sacc. Antonie van Leeuwenhoek 18: 201-213.

-----. 1959. Über die Ascomycetengattung *Plochmopeltis* Theiss. Persoonia 1: 1-5.

----- and E. Müller. 1954. Die Gattungen der amerosporen Pyrenomyceten. Beitr. Kryptogamenfl. Schweiz 11(1): 1-434.

Barr, M. E. 1968. The Venturiaceae in North America. Canad. J. Bot. 46: 799-864.

-----. 1978.The Diaporthales in North America with emphasis on *Gnomonia* and its segregates. Mycol. Mem. 7: 1-232.

-----. 1983. Muriform ascospores in class Ascomycetes. Mycotaxon 18: 149-157.

-----. 1987a. New taxa and combinations in the Loculoascomycetes. Mycotaxon 19: 501-505.

-----. 1987b. Prodromus to class Loculoascomycetes. Publ. by the author, Amherst, MA. 168 p.

-----. 1989. Some unitunicate taxa excluded from *Didymosphaeria*. Stud. Mycol. Baarn 31: 23-27.

-----. 1990a. Melanommatales (Loculoascomycetes). N. Amer. Fl. Ser. II, 13: 1-129.

-----. 1990b. Prodromus to nonlichenized, pyrenomycetous members of class Hymenoascomycetes. Mycotaxon 39: 43-184.

-----. 1990c. Some dictyosporous genera and species of Pleosporales in North America. Mem. New York Bot. Gard. 62: 1-92.

-----. 1991a. Revisions and additions to the Diaporthales. Mycotaxon 41: 287-305.

-----. 1991b. Notes on and additions to North American members of the Herpotrichiellaceae. Mycotaxon 41: 419-436.

-----. 1992a. Additions to and notes on the Phaeosphaeriaceae (Pleosporales, Loculoascomycetes). Mycotaxon 43: 371-400.
------. 1992b. Notes on the Lophiostomataceae (Pleosporales). Mycotaxon 45: 191-221.
----- and J. Boise. 1985. A revision of *Exarmidium* (Ascomycetes). Mycotaxon 23: 233-240.
-----, C. T. Rogerson, S. J. Smith, and J. H. Haines. 1986. An annotated catalog of the Pyrenomycetes described by Charles H. Peck. Bull. New York State Mus. 459: 1-74.
Berlese, A. N. 1899. Icones fungorum (Pyrenomycetes). Vol. 2, fasc. 5: 113-216.
Bigelow, H. E., and M. E. Barr. 1963. Contribution to the fungus flora of northeastern North America. III. Rhodora 65: 289-309.
Bissett, J. 1986. A note on the typification of *Guignardia*. Mycotaxon 25: 519-522.
Booth, C. 1957.Studies of Pyrenomycetes: I. Four species of *Chaetosphaeria*, two with *Catenularia* conidia. II. *Melanopsamma pomiformis* and its *Stachybotrys* conidia. Mycol. Pap. 68: 1-27.
Carroll, G. C., and A. Munk. 1964. Studies on lignicolous Sordariaceae. Mycologia 56: 77-98.
Cash, E. K. 1954. A record of the fungi named by J. B. Ellis. Part III. Spec. Publ. USDA 2(III): 347-518.
Constantinescu, O., K. Holm, and L. Holm. 1989. Teleomorph-anamorph connections in Ascomycetes. 1-3. *Stanhughesia* (Hyphomycetes) new genus, the anamorph of *Ceramothyrium*. Stud. Mycol. Baarn 31: 69-84.
Ellis, J. B., and B. M. Everhart. 1892. The North American Pyrenomycetes. Publ. by the authors, Newfield, NJ. 793 p.
Gams, W. 1992. Report of the Committee for Fungi and Lichens: new series, 2. Taxon 41: 99-108.
Hawksworth, D. L., and J. C. David. 1989. (933) Proposal to conserve *Guignardia* Viala & Ravaz with *G. bidwellii* as type. Taxon 38: 494-495.
Hilber, O., R. Hilber, and O. K. Miller Jr. 1987. Fungi of the Appalachian mountains. Mycotaxon 30: 269-288.
Hilber, R., and O. Hilber. 1979. Einige Anmerkungen zu der Gattung *Cercophora* Fuckel(Lasiosphaeriaceae). Z. Mykol. 45: 209-233.
Huhndorf, S. M. 1992a. The systematics of *Leptosphaeria* species found on the Rosaceae. Illinois Nat. Hist. Surv. Bull. 34(5): 479-534.
-----. 1992b. Neotropical ascomycetes I. *Valsonectria cinnamomi* in artificial culture. Mycologia 84: (in press).
Hyde, K. D. 1988. The genus *Linocarpon* from the mangrove palm *Nypa fruticans*. Trans. Mycol. Soc. Japan 29: 339-350.
Krug, J. C. 1977 (1978). The genus *Cainia* and a new family, Cainiaceae. Sydowia 30: 122-133.

Martin, P. 1967. Studies in the Xylariaceae: II. *Rosellinia* and the Primocinerea section of *Hypoxylon*. J. S. African Bot. 33: 315-328.

Munk, A. 1957. Danish Pyrenomycetes. Dansk Bot. Arkiv. 17(1): 1-491.

Nannfeldt, J. A. 1975. Stray studies in the Coronophorales (Pyrenomycetes) 4-8. Svensk Bot. Tidskr. 69: 289-335.

Rappaz, F. 1987. Taxonomie et nomenclature des Diatrypacees à asques octospores. Mycol. Helvetica 2: 285-648.

Romero, A. I., and G. J. Samuels. 1991. Studies on xylophilous fungi from Argentina. VI. Ascomycotina on *Eucalyptus viminalis* (Myrtaceae). Sydowia 43: 228-248.

Rossman, A. Y. 1977. The genus *Ophionectria* (Euascomycetes, Hypocreales). Mycologia 69: 355-391.

Samuels, G. J. 1973. The genus *Macbridella* with notes on *Calostilbe*, *Herpotrichia*, *Phaeonectria*, and *Letendraea*. Canad. J. Bot. 51: 1275-1283.

-----, E. Müller, and O. Petrini. 1987. Studies in the Amphisphaeriaceae (sensu lato) 3. New species of *Monographella* and *Pestalosphaeria*, and two new genera Mycotaxon 28: 473-499.

Seaver, F. J. 1910. Order Hypocreales. N. Amer. Fl. 3(1): 1-56.

Shoemaker, R. A., and C. E. Babcock. 1987. *Wettsteinina*. Canad. J. Bot. 65: 373-405.

-----, and K. N. Egger. 1982. *Endoxylina allantospora*. Fungi Canad. No. 227.

Sivanesan, A. 1975. Redispositions and descriptions of some *Amphisphaeria* species and a note on *Macrovalsaria*. Trans. Brit. Mycol. Soc. 65: 395-402.

Spooner, B. M. 1986. New or rare British microfungi from Esher Common, Surrey. Trans. brit. Mycol. Soc. 86: 401-408.

MYCOTAXON

Volume XLVI, pp. 77-84 January-March 1993

Calvatia pachyderma (Peck) Morg. and *Gastropila fragilis* (Lév.) Homrich et Wright, two possible names for the same fungus

V. DEMOULIN

Département de Botanique - B-22,
Université de Liège (Sart Tilman)
B-4000 Liège I, Belgium

Abstract

A new study of the holotypes shows both Ponce de Leon (1976) and Wright (1990) are correct in synonymizing *Lycoperdon pachydermum* Peck and *Mycenastrum fragile* Lév. The verrucose spores attributed by Calonge and Martin (1990) to the type of *Lycoperdon pachydermum* are a contamination. *Lycoperdon pachydermum* ss. Calonge and Martin is *Calvatia booniana* A.H. Smith.

Résumé

Une nouvelle étude des holotypes montre que Ponce de Leon (1976) et Wright (1990) étaient corrects en synonymisant *Lycoperdon pachydermum* Peck et *Mycenastrum fragile* Lév. Les spores verruqueuses attribuées par Calonge et Martin (1990) au type de *Lycoperdon pachydermum*

sont une contamination. *Lycoperdon pachydermum* ss. Calonge et Martin est *Calvatia booniana* A.H. Smith.

In 1970 I studied Peck's collections of Lycoperdon in the New York State Museum in Albany and did not find a ripe type specimen of *Lycoperdon pachydermum* Peck, Bot. Gaz. (Crawfordsville) VII:54 (1882). In my paper on typification of *Lycoperdon* described by Peck and Morgan (1979), I relied on an isotype in the New York Botanical Garden to make an opinion on Peck's species. The pieces in NY have unfortunately lost all of their spores but what remains of the capillitum and especially the typical endoperidium fit well the concept of the species as established by Zeller and Smith (1964). It is on this basis that I identified as *Calvatia pachyderma* (Peck) Morg. a large puffball I had collected on the french Mediterranean coast and which was also found in Spain (Demoulin, Martin and Calonge, 1988).

I was thus surprised to see Calonge and Martin (1990) report on a mature type specimen of *Lycoperdon pachydermum* deposited in NYS which presented verrucose spores. The answer to the problem is probably that the specimen in question had been on loan in 1970 to P. Ponce de Leon who annotated it in March 1972. Ponce de Leon published his study of this type in 1976 in a paper devoted to the genus *Gastropila* and I overlooked the fact that the type of a *Lycoperdon* name was discussed there. This 1976 paper was also overlooked by Wright who in 1990 reported his examination of the type of *Lycoperdon pachydermum* and concluded that it was identical with *Gastropila fragilis* (Lév.) Homrich & Wright. Ponce de Leon had reached the same conclusion and gave SEM pictures of the spores and capillitium of the two types. Those pictures show perfectly smooth spores which is a unique character in Lycoperdaceae and similar to those we found in the european material reported in 1988.

Given the contradiction between Calonge and Martin on one side, and Ponce de Leon and Wright on the other side, I had to reexamine the type of *Lycoperdon pachydermum*. I also compared it to those of *Gastropila*

fragilis and *Calvatia booniana.*

The heart of the problem lies in the fact that no large piece of gleba is preserved in the Peck collection which consists of broken pieces of peridium. Spore dust is present on those pieces of peridium but contaminant spores of another puffball must be present for one can observe in some areas both smooth and warted spores. Calonge and Martin decided that the warted spores belonged to the type and that the smooth spores were the contaminant, while the reverse is true. By carefully examining the pieces of peridium under a dissecting microscope, it was possible to select spots where some gleba was still attached. In the innermost part of those areas the spores were of the smooth type only. It was further discovered that smooth spores were constant while the verrucose ones were not encountered everywhere. My measurement of the smooth spores are 4,2-4,7-5,4 x 3,4-3,8-4,1 µm. An indirect argument also lies in the structure of the peridium : in my experience this is unique to the smooth spored taxon.

It is not surprising that the type of *L.pachydermum* became contamined since it was repacked. The label bears "*Calvatia pachyderma*" a combination made eight years after publication of the species in *Lycoperdon*. Further as we will see below, this collection has cohabited with large specimens of the rough spored *Calvatia booniana*.

Examination of the type of *Mycenastrum fragile* Lév., Ann. Sc. Nat., Bot, ser. 3,2:221 (1844) deposited in the Cryptogamic Herbarium of the Paris Natural History Museum confirmed its identity with *Lycoperdon pachydermum*. This is also a broken specimen but more gleba is preserved and it is not contaminated. My measurement of the spores is 4,5-4,9-5,2 x 4,2-4,5-4,7 µm.

In both types the capillium reaches 6,4µm in diam. with a wall up to 1,0µm in *L. pachydermum* and 1,2 µm in *M. fragile*. It presents numerous punctiform pores and disarticulates at septa. The endoperidium is very thick with septate thick walled hyphae (up to 8,0 µm, wall 1,4 µm in *L.p.*, 5,2 µm, wall 1,0 µm in *M. f.*). Very wide elements up to 17 µm in

diam. have been observed in *L.p.* but not *M.f.* My experience with the homogeneous european material is, however, that the development of those swollen elements is dependant on the ripening process and varies greatly even in different parts of a fruitbody.

I am thus convinced *Lycoperdon pachydermum* and *Mycenastrum fragile* are synonymous. One will note that both epithets can be used for if one segregates this fungus in the genus *Gastropila* the correct name is certainly *G. fragilis* (Lév.) Homrich et Wright. If however one prefers to retain it in the genus *Calvatia*, given the existence of a *Calvatia fragilis* (Vitt.) Morg., the combination *C. pachyderma* (Peck) Morg. is the correct one.

A final question is what is *Lycoperdon pachydermum* ss. Calonge et Martin, for which they use the combination *Langermannia p.* (Peck) Kreisel (Feddes Report. 64:120, 1962, not Beih. Nova Hedwigia 25:202, 1967 as stated) ?

I could solve this problem through the fact that I received on loan from NYS the other *Calvatia pachyderma* specimens from Peck's herbarium. Two of those are presumably duplicates of collections which Calonge and Martin recorded from NCU as *Langermannia pachyderma*. The collections are "Salt Lake Co., Utah, sept 1904, A.D. Garrett 534" and "California, Wm. R. Dudley 309". Another collection, "California, W.R.Dudley 56", matches perfectly the type of *L. pachydermum* while the aforementionned two, although superficially similar present verrucose spores. With the optical microscope the warts can only be seen by staining them with methylene blue in 10 % ammonia. There is also a slight difference in peridium appearance, but more importantly in its structure. The endoperidium is not particularly thick nor made of thick walled septate elements. The capillitium also seems to remain more cottony by not disintegrating easily at the otherwise abundant septa and the pores seem more irregular in distribution. Those characters match well the type of *Calvatia booniana* A.H. Smith in S.M. Zeller and A.H. Smith, Lloydia 27:164, 1964 I have seen in MICH ,a part of which is in LG.

If A.H. Smith gave me a part of this type specimen it is in fact because I intended to study more thoroughly the attribution to *Langermannia* proposed by Kreisel.

At the moment I consider *Langermannia* a weakly defined genus, and were it not for tradition, would merge it with *Calvatia*. If it is retained however, one of the most typical characters is the smooth peridium due to a thick hyphal outer layer which dominates over a reduced pseudoparenchymatous layer. Together with a rather tenacious endoperidium this aids dispersal by rolling of the whole fruitbody.

In *Calvatia booniana* the endoperidium is fragile and much of the exoperidium is more or less pseudoparenchymatous, hence the cracking into broad warts. I would thus not anymore consider a transfer of *Calvatia booniana* to *Langermannia*. One should also note that *Calvatia pachyderma* ss. Swoboda (1940) from Iran is also *Calvatia booniana* or a very close taxon as testified by the exoperidial aspect, dominance of exo- over endoperidium and punctate spores. This is probably the same fungus that was reported from Nepal by Kreisel (1989).

Whether one should retain the genus *Gastropila* or not is very much a matter of taste. Before considering this issue one must be conscious of the methodological problems linked to the study of peridial anatomy in Lycoperdaceae. One will only get a clear idea of those stuctures by boiling very thin sections in chloral hydrate. The ideal stage is rather transient for not all stuctures can be satisfactorally rehydrated in mature fruitbodies, while in immature ones not all structures are formed. The ideal stage, which is not easily found, is a fruitbody just before ripening. In *Calvatia* the difficulties are especially important because of the large size of the fruitbodies which when collected unripe will undergo even more than small species anomalous ripening, if not quickly heat dried. Many herbarium collections are indeed of such "notreif" as said Kreisel, specimens and present untypical anatomy. This explains the difficulty of many authors to interprete the peridial structure of Lycoperdaceae even if this structure does

in fact answer a very constant pattern.

For those reasons I am reluctant to modify accepted generic concepts in the *Calvatia*-like fungi as long as I have not been able to study the anatomy of more adequate material. Nonetheless since my 1971 thesis (fig 25), I contend that *Calvatia* is an artificial grouping of at least three phyletic entities that when based on spores, capillitum and peridial characters can be related to various clades of *Lycoperdon*. Dismembering of the genus especially on the basis of single characters, as was done by Kreisel (1989, 1992) with capillitum pore shape for *Handkea*, is however in my opinion premature, and I prefer to provisionnaly maintain a large artificial genus *Calvatia*. *Gastropila* is, I admit well characterized by its smooth spores and very thick endoperidium, a character well noted by Peck, while later authors often failed to notice that the important point was the thickness of the endoperidium, not the thickness of the peridium as a whole.

I consider *Gastropila* to certainly be as acceptable a genus as *Langermannia*, but I personally prefer not to use it for the following reason. The species in my opinion closest to *Calvatia pachyderma* is *Calvatia craniiformis* (Schw.) Fr., the type species of the genus, which has an endoperidium made up of thick walled spherocysts and almost smooth spores. One should remember I consider the loss of warts in a *Lycoperdaceae* spores a derived character in the light of our observations on spore wall ultrastructure in Gasteromycetes (Bronchart et al., 1975). Absence of subgleba is a character that can be either primitive or derived, but in my opinion in the Lycoperdaceae, it is usually derived, and not of generic value. I would thus suspect *Calvatia pachyderma* to be a rather close derivative of *Calvatia craniiformis*, much closer phylogenetically to that species than to many other *Calvatia*.

Aknowledgments

In am much indebted to the curators of the fungal herbaria in the Museum d'Histoire Naturelle Paris (PC) and New York State Museum Albany (NYS) for loan of Leveillé and Peck collections.

References

Bronchart, R., Calonge, F.D. and Demoulin, V., 1975. Nouvelle contribution à l'étude de l'ultrastructure de la paroi sporale des Gastéromycètes. Bull. Soc. Mycol. France 91:231-246.

Calonge, F.D. and Martin, M.P. , 1990. Notes on the taxonomical delimitation in the genera *Calvatia*, *Gastropila* and *Langermannia (Gasteromycetes)*. Bol. Soc. Micol. Madrid 14:181-190.

Demoulin, V., 1971. Le genre *Lycoperdon* en Europe et en Amérique du Nord / Etude taxonomique et phytogéographique. Doctoral thesis, University of Liège. 284 pp. + 25 + 45 pp. of ill. Available in photocopies from Koeltz Scientific Books, Koenigstein

Demoulin, V., 1979. The typification of *Lycoperdon* described by Peck and Morgan. Beih. Sydowia VIII:139-151.

Demoulin, V., Martin, M.P. & Calonge, F.D., 1988. *Calvatia pachyderma* (Peck) Morgan (Gasteromycetes), nueva para Europa. Bol. Soc. Micol. Madrid 12:85-88.

Kreisel, H., 1989. Studies in the Calvatia complex (Basidiomycetes). Nova Hedwigia 48:281-296.

Kreisel, H., 1992. An emendation and preliminary survey of the genus Calvatia (Gasteromycetidae). Persoonia 14: 431-439.

Ponce de Leon, P., 1976. Notes on the genus *Gastropila*. Phytologia 33:455-466.

Swoboda, F., 1940. Zur Anatomie des Lycoperdaceen. II. Calvatia pachyderma (Peck) Morgan. Ann. Mycol. XXXVIII:1-13.

Wright, S.E., 1990. Calvatia pachyderma (Peck) Morgan is Gastropila fragilis (Lév.) Homrich & Wright. Mycotaxon XXVII:187-189.

Zeller, S.M. and Smith, A.H., 1964. The Genus *Calvatia* in North America. Lloydia 27:148-186.

MYCOTAXON

Volume XLVI, pp. 85-91 January-March 1993

UNUSUAL SPORE PRINT COLOURATION WITHIN THE FAMILY HYGROPHORACEAE:
Two distinctive taxa recorded from Tasmania

Alan Mills and Angela Monks*
Department of Plant Science, University of Tasmania, GPO Box 252C, Hobart Tasmania 7001 Australia

ABSTRACT

Two species of *Hygrocybe*, *H. lilaceolamellata* (Stevenson) Horak and *H. erythrocrenata* Monks and Mills sp. nov. are described from Tasmania. These two species appear to be exceptional representatives from the Family Hygrophoraceae as they produce spore prints of violet white, and, pale magenta to white (variable) colour respectively. Differing opinions about the colouration of the spore print of *Aeruginospora singularis* Höhnel are noted. It is suggested that fungi producing pale green, violet, magenta (or other?) coloured spore prints should be accepted within the Hygrophoraceae, and that tacit assumptions concerning the spore print colour of *A. singularis* need to be questioned.

INTRODUCTION

White spore prints are the accepted norm for members of the family Hygrophoraceae Roze. The only major exception known to us lies within the genus *Aeruginospora* Höhnel. *Aeruginospora singularis* Höhnel, the type species of this genus, is at the centre of some debate over the colour of its spore print. It was described by Höhnel (1908) as having a pale green ("Spangrün" - verdigris) spore print. Donk (1962) and Singer (1986) have indicated that they believe that the spore print of *A. singularis* is white, and whilst Horak (1968) concurred with Höhnel, Orton and Watling (1969) suggested that further field work on this species is necessary.

One assumption underlying this debate over the colour of the spore print of *A. singularis* is that the print colour is either white or green. Eger et al. (1979) have reported the following from the polyporaceous genus *Pleurotus* "variation within the progeny of single sporophores was observed i.e. buff, vinaceous buff, and vinaceous spore prints in the progeny of the white spored "F_4"". This is a firm indication of the variable colour of spore prints in one species of *Pleurotus*. There are implications in these observations when fungi from the Hygrophoraceae are considered.

* Present address. Department of Primary Industry, New Town Research Laboratories,St Johns Avenue, New Town, Tasmania 7008 Australia.

In this second paper* outlining the Hygrophoraceae of Tasmania, we report the presence of two fungi which deposit pallid violet to magenta spore prints. Both fungi are reported from Tasmania for the first time: *Hygrocybe lilaceolamellata* (Stevenson) Horak is now known from New Zealand and Tasmania; the other appears to be a new species which deposits spore prints of variable colour.

MATERIALS AND METHODS

Specimens were collected from various localities within Tasmania over a number of years, they were described fresh and then dried as soon as possible. Spore prints were obtained as soon as practicable after collection and generally represent spores dropped overnight. All spore prints were obtained on microscope slides and the colour of the massed spores noted immediately after the cap was removed. Colour codes and nomenclature used are those of Kornerup and Wanscher (1978). Sections and pieces of tissue were revived and examined in 10% aqueous ammonium hydroxide. Spore measurements, a minimum of 20 per cap, were taken from spores in spore prints or spores adhering to the stipe surface. All specimens listed are deposited at the Tasmanian Herbarium Hobart (HO).

OBSERVATIONS

Hygrocybe lilaceolamellata (Stevenson) Horak. Fig. 1 (a-b)

This taxon was found among the wetter hardwood forests of Tasmania in which *Nothofagus cunninghamii* forms a significant portion of the tree cover.

Macroscopically the specimens collected in Tasmania differed only marginally from the descriptions of Stevenson (1962) and Horak (1973, 1990). The most significant differences being (a) disc - finely scaley to scurfy from youth, and (b) lamellae - colours more-or-less consistently the somewhat greyer tones of Horak's descriptions to greyish magenta (14D3).

Microscopic features were largely consistent with published data and showed only minor differences e.g. (a) Mature spores exhibited a wider range of dimensions than recorded by previous authors, from 5.5-8 x 3-5 μm (Average 6.28 x 3.76) in one cap from HO 124676 up to and including those published by Horak (1990) from caps of other collections. (b) the apiculus was considerably more substantial than that depicted by Horak, and whilst the spores were definitely constricted they did not consistently have the more pronounced waist shown in Horak's (1973 and 1990) drawings. The overall result is that the spores from the Tasmanian specimens appear to be more voluminous than those from New Zealand (see Fig. 1).

---

*Paper 1. Monks A. and Mills A. (1991) *Camarophyllus rodwayi* a Rediscovered Fungus. In Aspects of Tasmanian Botany a Tribute to Winifred Curtis. Pap. Proc. Roy. Soc. Tas. M. Banks, S. Smith, A. Orchard and G. Kantvilas Eds.

Features not noted by earlier investigators were
(a) Spore print violet white (18A2) in all caps tested
(b) Hymenophoral trama regular to very slightly divergent in sections from fresh basidiomes.

Specimens examined. Tasmania: Pipeline Road, N.W. under *Nothofagus* V. 1990, Robinson and Fuhrer HO 124676; Little Florentine River valley (near Strathgordon Road crossing) under mixed forest on mossy soil 1989 Monks; Mt Field National Park (Lyrebird walk) on soil beneath *Atherosperma/Eucalyptus* forest IV 1991 Mills 1062.

Hygrocybe erythrocrenata Monks and Mills sp. nov. Fig. 1 (c-f)

Pileus 10-35 mm, hemisphericus vel obtuse conicus, lateritius, striatus, siccus, lamellae distantes, subdecurrentes vel decurrentes, subroseae vel albidae. Stipes 25-70 x 1.5-4 mm, pileo concoloratus vel rufus, cylindricus. Sporae (5.5)6-8 x 3.5-5 μm, ellipticae, laeves, hyalinae, nonamyloideae. Fibulae presentes. Ad terram inter muscos in silvis. Tasmania. Holotypus HO 131196.

Pileus 10-35 mm, hemispherical to broadly campanulate or obtusely conical sometimes planoconvex with broad obtuse umbo, centre subdepressed to depressed at maturity, brownish red (8C8) to reddish brown (8D 7-8) fading rapidly to pale yellow on partial drying then to greyish orange when fully dry, dry, hygrophanous, becoming scurfy at centre when mature margin striate when moist, nonstriate dry, crenate to subcrenate,. Lamellae subdecurrent to decurrent, distant, thick, waxy, white or yellowish white to pinkish white (7-10A2) or pallid reddish grey (pallid 12B2). Stipe 25-70 x 1.5-4 mm, equal to somewhat swollen at base, dry, smooth, single to densely gregarious, red (8A7), remains red after drying.

Spore print either white or greyish magenta (13D4). Spores (5.5) 6-8 x 3.5-5 μm mostly elliptic to ovate, sometimes constricted, hyaline, smooth, inamyloid. Basidia 34-60 x 6-8 μm, 2 and 4 spored. Basidioles present. Pileipellis a cutis of cylindrical non-gelatinised hyphae 5-7.5 μm diam., cytoplasmic pigments present. Clamp connections present. Hymenophoral trama regular to somewhat irregular.

Ecology. On soil in disturbed and non-disturbed sites in litter or growing among mosses under *Nothofagus cunninghamii* or mixed forest (*N. cunninghamii* and *Eucalyptus* spp with or without *Acacia* spp and *Atherosperma moschatum*). May to August.

Distribution. In wetter forest regions of Tasmania including wet gullies in eastern Tasmania.

Comments. The red-brown capped basidiomes were found at widely dispersed localities in Tasmania. They are readily characterised by their crenate reddish cap with decurrent white to pallid pinkish grey gills and red stipe. When dried the distinctive pattern of pallid yellow to pale greyish orange cap with red stipe and gills which intensify

the fresh colours makes identification very simple.

There is no doubt that the caps producing the different coloured spore prints are of the same species. They were collected from basidiomes
in the same populations occupying an area of more-or-less one square metre, and apart from the spore print/lamellae colour differences they are macroscopically and microscopically indistinguishable. It should also be noted that all of the spore print colours reported here were from fresh spore prints, and the colour variation seen does not represent fading of the spore print colour due to desiccation or other causes. The colouration of the fresh print can be predicted following examination of the lamellae prior to the spores being deposited. Print colour is stable for some days.

HOLOTYPE: Tasmania, HO 131196, on soil in mixed forest Moonlight Ridge (near Lune River). VIII 1989 Monks.

Additional specimens examined. Tasmania: Hellyer Gorge (near Burnie) on soil under mixed *Nothofagus*, *Eucryphia*, *Acacia*, *Atherosperma*, Eucalyptus forest V. 1987, Mills 683 and 685; Mt Read (near Roseberry) on soil under mixed *Nothofagus* forest, IV. 1991, Mills 1012; Little Florentine River valley (near Strathgordon Road) on soil beneath mixed forest, VI. 1991, Mills 1014.

DISCUSSION

The two fungi described above both clearly belong within the family Hygrophoraceae. They possess the characteristically elongate basidia, generally broad hyphae in the hymenophoral trama, simple pileipellis and inamyloid spores which are to some extent constricted, all features reported from several taxa of the Hygrophoraceae. *Hygrocybe lilaceolamellata* was previously placed in the Hygrophoraceae by both Stevenson (1962) and Horak (1973 and 1990).

Hygrocybe Kummer would seem the appropriate genus into which these two species should be placed. Clamp connections in the pileipellis and the arrangement of hymenophoral trama, basically regular in both cases, makes this placement apposite. *H. lilaceolamellata* had regular to very faintly divergent hymenophoral trama, and although divergent trama is considered to be characteristic of the related genus *Hygrophorus*, it was felt that the arrangement of hyphae seen was much closer to that proposed for *Hygrocybe* rather than *Hygrophorus*.

Only the spore prints do not conform to the traditional circumscription of the genus. The violet white print of *H. lilaceolamellata* and greyish magenta print of *H. erythrocrenata* are unusual within the Hygrophoraceae, as is the fact that *H. erythrocrenata* produces coloured prints or white prints from different basidiomes. Probably the simplest explanation for the separate white and coloured spore prints of *H. erythrocrenata* is that of a single gene mutation in the appropriate colour pathway. Genetic recombination within the Tasmanian population would allow expression of the mutant gene.

Hesler and Smith (1963) placed considerable emphasis on the white spore prints of the

FIG. 1. a,b, spores from *Hygrocybe lilaceolamellata* (Stevenson) Horak; a) redawn from Horak (1990) and b) from Monks 217 and Mills 1062: c to f) *Hygrocybe erythrocrenata* Monks and Mills; c) basidiomes, d and f) basidia and spores respectively all from HO 131196 (holotype), e)basidia with basidioles from Mills 1012. Scale bar represents 20 mm for basidiomes, 20 μm for basidia, and 10 μm for spores.

Hygrophoraceae. At about the same time Singer (1962) included *Aeruginospora* Höhnel as a separate Genus within this Family despite misgivings about the spore print colour. Later Singer (1986) placed *Aeruginospora* in synonomy under the genus *Hygrocybe* and stated his opinion that *Aeruginospora singularis* had a white spore print. However, examination of the keys to Families and Genera in Singer (1986) indicates that coloured spore prints within the Family Hygrophoraceae are not ruled out by this author.

When considering spore prints from fungi of F. Hygrophoraceae the evidence presented in this paper would seem to indicate that a wider range of spore print colours should be accepted; i.e. that fungi depositing pale green, voilet, magenta (or other?) coloured spore prints may be included as valid members of the Hygrophoraceae, along with the white spored species. Within the Agaricales sensu Singer (1986), the occurrence of more than one colour of spore print within a single taxonomic entity is not unusual. Well known examples occur in such families as the Strophariaceae with purplish or brown prints, and Tricholomataceae with white or variously coloured prints (Singer 1986). In the case of the genus *Melanophyllum* (Agaricaceae), Horak (pers. com.) has observed that the green spore print of *M. eyrei* and the pink-reddish brown print of *M. echinatum* are accepted within the same genus, and there is no continuing debate over their taxonomic position within this genus. To exclude all fungi producing non-white spore prints from the Hygrophoraceae would lead to the exclusion of *Hygrocybe lilaceolamellata* and *H. erythrocrenata*. These two species have morphological, basidial, spore and hyphal features characteristic of the Hygrophoraceae, to exclude them on the basis of spore print colour would not follow precedents set within other families from the Agaricales. Thus there would seem to be little reason not to accept a range of spore print colours within the family Hygrophoraceae.

Further, if the evidence of variable coloured spore prints provided by *H. erythrocrenata* is taken into account, care must be exercised before the spore print of *A. singularis* is deemed to be white or green. It may indeed be both white and green. As Orton and Watling (1969) suggested, further field work on this species is necessary.

ACKNOWLEDGEMENTS

The authors wish to thank Dr E. Horak for his thoughtful suggestions and review of the manuscript which resulted in an improved paper.

LITERATURE CITED

EGER, G., SUI FONG LI, and LEAL-LARA, H. 1979. Contribution to the Discussion of the Species Concept in the *Pleurotus ostreatus* complex. *Mycologia* 71: 577-587.

DONK, M.A. 1962. The Generic Names proposed for Agaricaceae. *Nova Hedwigia Beiheft* 5. p. 9 J. Cramer.

HESLER, L.R. and SMITH, A.H. 1963. North American Species of Hygrophorus. University of Tennessee Press, Knoxville. 2,14,17,46 pp.

HÖHNEL, F. VON. 1908. Fragmente zur Mykologie, 472. *Sitzb. K. Akad. Wissensch. Wien, Math. Nat.* Kl. 117: 1012.

HORAK, E. 1968. Synopsis generum Agaricalium. Beitr. zur Kryptogamen Flora Schweiz. 13. 65 p.

HORAK, E. 1973. Fungi Agaricini Novazelandiae. III. *Hygrophorus* Fr. and related genera. *Nova Hedwigia. Beiheft* 43: 115-182.
HORAK, E. 1990. Monograph of the New Zealand Hygrophoraceae (Agaricales). *New Zealand J. Bot*. 28: 255-309.
KORNERUP , A. and WANSCHER, J.H. 1978. Methuen Handbook of Colour. 3rd Ed. Methuen. London. 252 p.
ORTON, P.D. and WATLING, R. 1969. A Reconsideration of the Classification of the Hygrophoraceae. Notes from the Royal Botanic Garden 29: 129-138.
SINGER, R. 1962. Agaricales in Modern Taxonomy. 2nd Ed. J. Cramer, Vaduz 915 p.
SINGER, R. 1986. Agaricales in Modern Taxonomy. 4th Ed. Koeltz Scientific Books, Koenigstein, FRG. 981 p.
STEVENSON, G. 1962. The Agaricales of New Zealand. IV. Hygrophoraceae. *Kew Bulletin* 16: 373-384.

MYCOTAXON

Volume XLVI, pp. 93-96 January-March 1993

A REVISION OF BULBOUNCINULA BULBOSA: A NEW POWDERY MILDEW RECORD FROM TAIWAN, AND ITS PRESUMED ANAMORPH

KER-CHUNG KUO

Department of Plant Pathology, Cornell University, Ithaca, New York 14853
Pesticide Application Department, Taiwan Agricultural Chemicals and Toxic Substances Research Institute, Wufeng, Taichung, Taiwan, R.O.C.

ABSTRACT

Bulbouncinula bulbosa (Tai & Wei) Zheng and Chen was collected from *Koelreuteria elegans* A. C. Smith in Taiwan. A presumed anamorphic state not previously reported was associated with the teleomorphic state, both of which grew amphigenously on host leaves. This is the first report of *Bulbouncinula bulbosa* on *Koelreuteria elegans*, the first record from Taiwan, and the second collection of this species.

The genus *Bulbouncinula* Zheng and Chen was erected as a new genus in 1979 because of the bulbous base on *Uncinula*-like appendages and of the presence of short, club shaped appendages (Zheng and Chen,1979; Braun, 1987). The only (type) species is *Bulbouncinula bulbosa* (Tai & Wei) Zheng & Chen, which occurred on *Koelreuteria paniculata* Laxm., based on *Uncinula clintonii* Peck var. *bulbosa* Tai and Wei (1932). The variety was earlier raised to species rank as *U. bulbosa* (Tai & Wei) Tai (1935). The only previously known specimen was collected by Dr. F. L. Tai in Hangchow, Chekiang, China in 1932 and its anamorphic state was described as "unknown" (Zheng and Chen, 1979; Zheng, 1985).

A *Bulbouncinula* species on *Koelreuteria elegans* A. C. Smith was collected by the author at Wan-Ta, Nantou Hsien on November 21, 1989, and is deposited in CUP 61998, HAL, HMAS 62771 and IMI. The fungus occurred on leaves, was amphigenous, evanescent to persistent, with mycelial width between 2.9-5.1 μm. Cleistothecia were scattered to gregarious. Development of cleistothecia was observed by scanning electron microscopy (Figs. 1-4). Mature cleistothecia were 95-140 μm in diam., with outer cells irregularly polygonal, about 5-15 μm in diam.

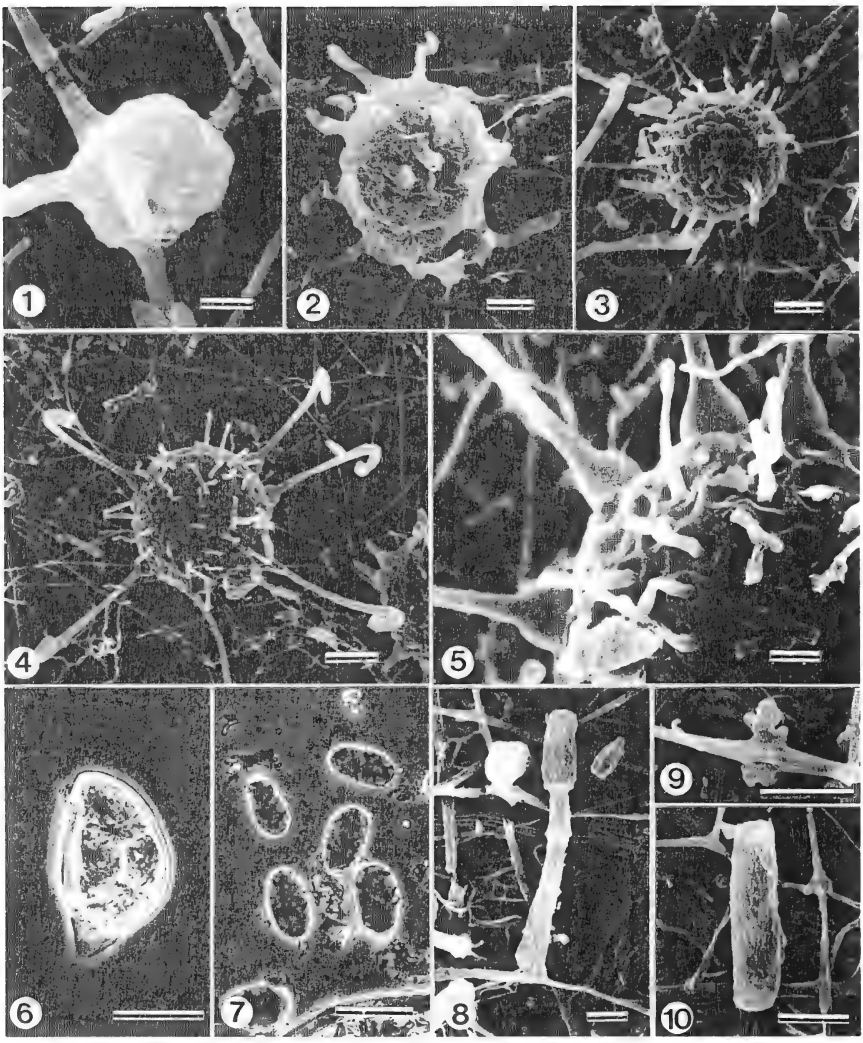


Fig. 1-10. Development of cleistothecia and conidia of *B. bulbosa*. 1. Cleistothecial initial. Bar=5 μm; 2. Ascocarp primodium with short-type appendage. Bar=10μm; 3. Young ascocarp with short-type appendages. Bar=30μm; 4. Mature ascocarp showing the bulbous base and uncinate apex of long type appendages and club shaped short-type appendages. Bar=50μm; 5. Close-up view of short-type appendages. Bar=15μm; 6. Ascus. Bar=20μm; 7. Ascospores. Bar=20μm; 8. Conidiophore. Bar=10μm; 9. Appressorium. Bar=10μm; 10. Conidium. Bar=10μm.

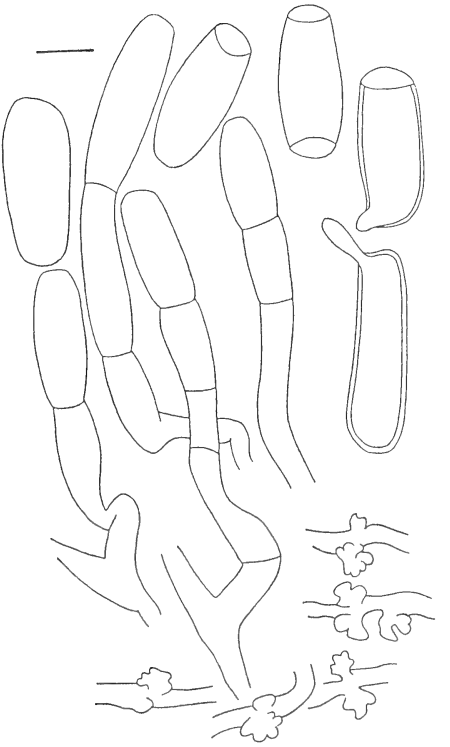


Fig. 11. Conidial stage of *Bulbouncinula bulbosa*. a, conidiophores; b. conidia; c, appressoria. Bar=10μm

Two types of appendages were present. The long *Uncinula* – type appendages arose equatorially, 4-11 per ascocarp, ca 120-156 μm long, uncinately curved at the apex, hyaline, the width 7.3-8.8 μm below, 8.0-13.2 μm above, with thicker cell walls in the lower part but then thinner gradually through the upper part, the bulbous base brown or dark brown, 16-24 μm in diam. With one septum between bulbous base and uncinate appendage. The short-type appendages grew on the upper part of the cleistothecia, and were club shaped and appeared to be capitate after gelatinizing at maturity, 11-38.9 × 2.2-7.3 μm (Fig. 5). Asci were ovoid, with a short stalk, 38.2-58.7 × 25.7-42.6 μm, 6-10 asci in an ascocarp, generally 8 ascospores in an ascus. Ascospores were oblong or ellipsoid, hyaline, 20-25 × 10-12.5 μm (Fig. 7). The conidiophores were 44-110 × 3.7-8.8 μm, and consist of 1-4 cells, foot cells curved to flexuous (Figs. 8, 11a). Appressoria were multilobed, mostly opposite in pairs (Figs. 9, 11c). Conidia were ellipsoid, doliiform, 20.5-35.2 × 8.8-13.9 μm, with a germ tube at one end (Figs. 10, 11b). According to the teleomorph, our specimen is identified as *Bulbouncinula bulbosa*, and my study on checking an isotype of *B. bulbosa* (HMAS 11460) also confirmed the presence of the same type of appressoria and conidia, not mentioned in previous descriptions.

The gelatinized material giving the short type appendages a capitate apex is not evident in SEM material, possibly caused by immature material or by the fixation procedures for SEM photography (Figs. 2-5).

ACKNOWLEDGEMENTS

The author thanks Dr. Ru-yong Zheng, Academia Sinica, Beijing, China for loan of the isotype specimen of *Bulbouncinula bulbosa* from Herbarium Mycologicum, Academia Sinica (HMAS 11460), and for presubmission review. The author also appreciates the assistance and presubmission reviews of Dr. Richard P. Korf, Director of the Cornell Plant Pathology Herbarium, and of Dr. Uwe Braun, Martin-Luther-University, Halle, Germany. Thanks are also due to Ms. Zhe-fang Han for inking the line drawing and Mr. Chi-yee Lee for scanning electron microscopy.

REFERENCES

Braun, U. (1987). A monograph of the Erysiphales (powdery mildews). *Beihefte zur Nova Hedwigia* **89**, 1-700.

Tai, F. L. (1935). Notes on Chinese fungi V. Further studies on Erysiphaceae of China. *Bull. Chinese Bot. Soc.* **1**, 11-35.

Tai, F. L. and Wei, C. T. (1932). Notes on Chinese fungi II. *Sinensia* **3**, 93-130.

Zheng, R.-y. (1985). Genera of the Erysiphales. *Mycotaxon* **22**, 209-263.

Zheng, R.-y. and Chen, G.-q. (1979). Taxonomic studies on the genus *Bulbouncinula* of China. 1. The establishment of the genus *Bulbouncinula* gen. nov. *Acta Microbiol. Sinica* **19**, 375-378.

MYCOTAXON

Volume XLVI, pp. 97-104 January-March 1993

MYCENA GAULTHERI REDISCOVERED AFTER 50 YEARS

SCOTT A. REDHEAD

Centre for Land and Biological Resources Research
Research Branch, Agriculture Canada
Ottawa, Ontario, Canada, K1A 0C6

and

LORELEI L. NORVELL

Department of Botany, KB-15
University of Washington
Seattle, WA 98195, U.S.A.

ABSTRACT - Examination of recent collections of *Mycena gaultheri* confirms that there are significant taxonomic features separating it from members of sections *Polyadelphia* and *Basidipedes*; therefore a new section *Testudini* is proposed. Range extension from Washington to Oregon is noted.

KEY WORDS: *Mycena sect. Testudini*, *Pseudotsuga*, *Gaultheria*, Oregon, Washington, biodiversity, Basidiomycetes, Agaricales, Tricholomataceae, Xerulaceae.

INTRODUCTION

In North America the focus of most studies of higher fungi has shifted from strictly taxonomic and floristic research to biologically oriented investigations. As a result, agaricologists have been increasingly confronted in recent years by two fundamental biological questions: [1] What are the ecological effects of commercial harvesting of mushrooms on fungal and plant populations and [2] where are the areas of greatest fungal biodiversity? In 1986 the Oregon Mycological Society set up 10 permanent study plots in the Bull Run Watershed near Mt. Hood,

Oregon. The primary goal of studying the impact of harvesting on chanterelle productivity was combined with an investigation of fungal biodiversity in the 100-year old *Tsuga heterophylla/Pseudotsuga menziesii* forest (Norvell 1987, 1991).

Consistent intensive sampling of all macrofungi on the plots has revealed approximately 25 species of *Mycena* among the 215 fungi thus far enumerated. One of these was *Mycena gaultheri*, an apparently rare species not found since the type was collected on Sept. 29, 1941 in the Olympic Mountains of Washington (Smith 1947).

TAXONOMY

Aside from the range extension to Oregon, rediscovery of this unusual species has allowed us to resolve fundamental questions about its morphology and anatomy raised by Maas Geesteranus (1980, 1986). Unable to borrow the scant type material, he suggested that the species might better belong in *Mycena* sect. *Polyadelphia* Singer ex Maas G. rather than *Mycena* sect. *Basipedes* (Fr.) Quél. where Smith (1947) had placed it. Macroscopic examination of the holotype (Smith 17390, MICH) by Redhead at Ann Arbor confirmed the curator's communication to Maas Geesteranus that very little remains of the type (2 fragmented basidiomes). However, macroscopically basidiomes of the type and the recent collections resemble each other. Furthermore, our microscopic examination of the recent finds confirms Smith's original observations of the characteristic gelatinized pileipellis covered by a hymeniform layer of diverticulate cells (Figs. 1, 5-6).

The following description is based on the 2 Oregon specimens:

MYCENA GAULTHERI SMITH, 1947. NORTH AMERICA SPECIES OF *MYCENA*, P. 51. **Figs. 1-6.**

PILEI up to 2.5 mm wide, convex, striate, with a broad central disc with scalloped edges; uniformly citrine-yellow coloured. **LAMELLAE** 9 in number, extending from the pileus edge to a scalloped collar surrounding the stipe apex, alternating with one tier of lamellulae; pallid. **STIPE** up to 23 mm long, less than 1 mm wide [400-450 μm], apex whitish through yellow grading to peach and

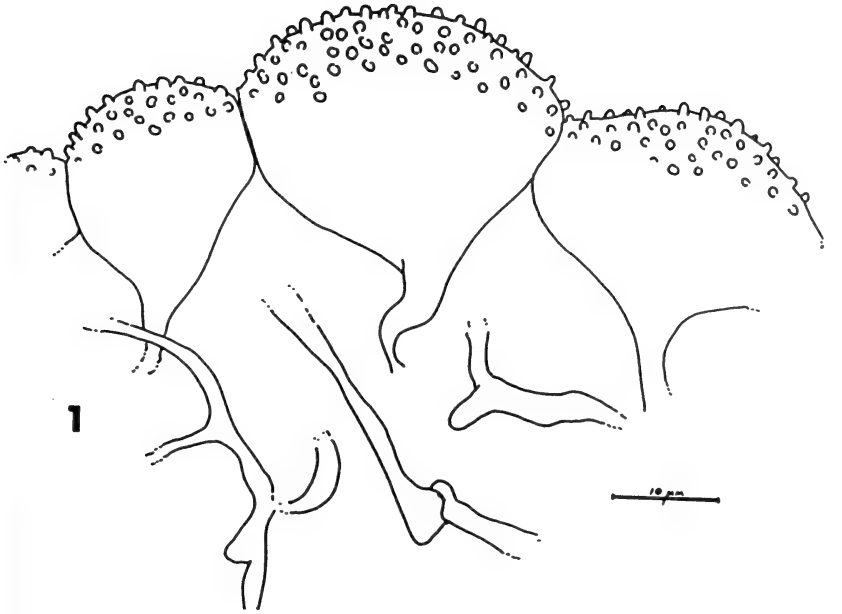


Fig. 1. Hymeniform pileipellis over gelatinous layer (DAOM 215200). Scale = 10 μm.

---

salmon colour basally; the slightly swollen turbinate base up to 1 mm diam., attached to leaf fragment.

Basidiospores (Fig. 4) 8.3-9.9 x 3.9-4.5 μm excluding apiculus, broadly cylindrical, prominently apiculate, smooth, thin-walled, hyaline, amyloid. **Pileipellis** (Figs. 5-6) a thick gelatinized layer 30-50 μm deep with embedded ascending hyphae 1.5-3 μm diam., corticated by a monolayer of pedicillate lentiform/clavate cells; cells (Fig. 1) 17-30 μm wide, ca. 20 μm deep on short pedicels, densely diverticulate on the exposed surfaces; the walls thin but pronounced, nonamyloid. **Pileus trama** 22-25 μm thick, composed of thin-walled, hyaline, dextrinoid hyphae, 9-21 μm diam., separated from the gelatinized pileipellis by a slightly denser hyphal layer; clamped. **Basidia** (Fig. 3) 18-21 x 7.2-8.1 μm, mostly 4-spored, with scattered 1-, 3- spored aberrant basidia, clamped. **Cheilocystidia** (Fig. 2) forming a sterile gelatinized removable margin, 13.5-20.7 x

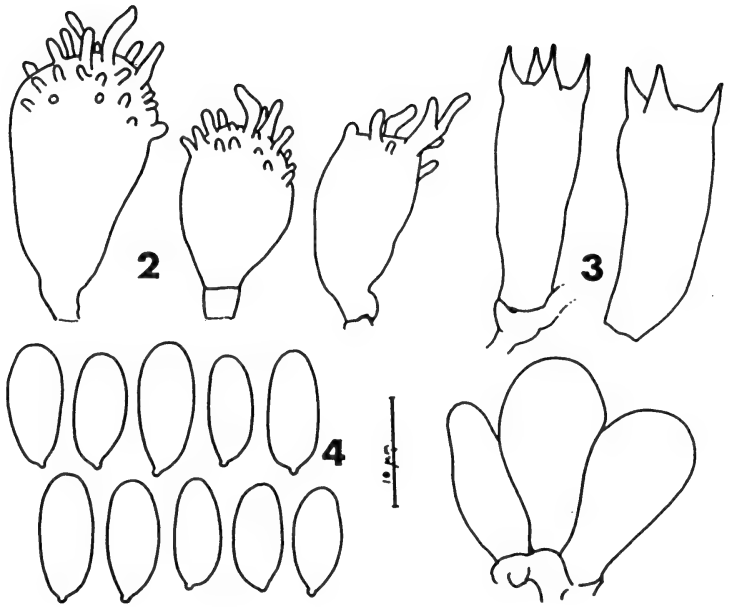


Fig. 2. Cheilocystidia. Fig. 3. Basidia & basidioles. Fig. 4. Basidiospores (DAOM 215200). Scale = 10 μm.

7.7-12.2 μm, irregularly clavate with prominent short and a few longer, occasionally branched apical diverticulae; with thin but pronounced nonamyloid walls; with gelatinized bases and gelatinized subtending hyphae; clamped or occasionally secondarily septate basally. **PLEUROCYSTIDIA** absent. **LAMELLAR TRAMA** regular, the hyphae 9-22 μm diam, thin-walled, hyaline, dextrinoid. **STIPE TRAMA** parallel, hyaline, dextrinoid; hyphae mainly between 5-18 μm diam, on average tending to be narrower towards the cortical layer, clamped; oleiferous hyphae 2-5 μm diam., scattered. **STIPITIPELLIS** hyphae smooth, nongelatinized, with rare, scattered globose growths [abnormality ?]; abruptly differentiated from a disc-like pad of tissue in the pileus. The latter layer composed of hyphae 3-5 μm diam. and is itself surrounded by a second layer of generally radially organized cells between 21-27 μm diam. This second layer intergrades with the nongelatinized pilear and lamellar tramal tissues of dextrinoid hyphae. **STIPE BASE** composed of radially ascending

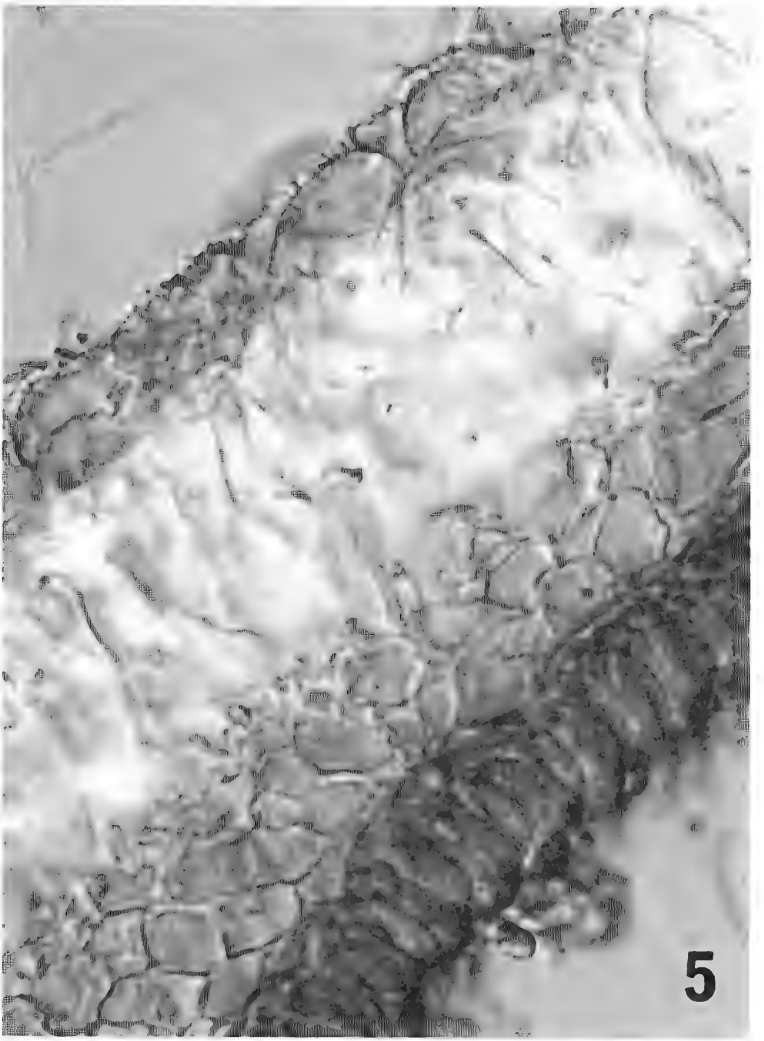


Fig. 5. Hymeniform pileipellis over gelatinous layer, inflated tramal cells, and hymenium. (DAOM 215200) 750x mag.

short cells up to 25 μm diam. towards the poorly defined marginal areas, lacking a distinctly ridged margin but fringed by thin-walled obtuse hairs, 5-10 μm diam., up to 100 μm long, with thin but pronounced walls, mostly covered by hyaline granular encrustations.

HABITAT: Erumpment from fragments of unidentifiable decaying foliar tissues amid *Gaultheria shallon* Pursh, *Cornus canadensis* L. and *Berberis nervosa* Pursh beneath *Tsuga heterophylla* (Raf.) Sarg., *Pseudotsuga menziesii* (Mir.) Franco, and *Acer circinatum* Pursh.

COLLECTIONS EXAMINED: U.S.A.: Oregon, Bull Run Watershed, Mt. Hood Natl. Forest, OCSP plots A2C & B5G, Oct. 28, 1991, coll. S. A. Redhead, L. L. Norvell & J. Roger (DAOM 215199, 215200).

Distinctive macroscopic features of *M. gaultheri* are the greenish colours of the pileus combined with an orangish pigmentation on the stipe (our collections with a peach to salmon-coloured base intergrading with yellow above; Smith's with a pale orange-yellow basal disc). Microscopically the species is even more distinctive. The very prominent gelatinized pileipellis bearing a cellular covering of swollen diverticulate ends is unlike any other *Mycena* species. Smith (1947) compared it to *M. mucor* (Batsch: Fr.) Gillet which as depicted by Kühner (1938) appears to have a nearly corticated gelatinized pileipellis. However, Maas Geesteranus (1983) describes the surface cells of the pileipellis of *M. mucor* as "...variously branched elements..." 3.5-12.5 μm diam.

Maas Geesteranus (1986) placed *M. gaultheri* into section *Polyadelphia* which he limited to species that lack abruptly differentiated tissues at the apex of the stipe and that generally have diverticulate stipitipellis hyphae. For these two reasons, we exclude *M. gaultheri* from this section.

Features which indicate placement in section *Basipedes* as defined by Kühner (1938), Smith (1947) and Maas Geesteranus (1980) are five: [1] the prominent disk of differentiated tissue capping the stipe in the pileus, [2] the free collar formed by the lamellae (as noted by Smith), [3] the swollen base with marginal differentiation into hairs, [4] gelatinized pileipellis as found in several species, and [5] the smooth stipitipellis hyphae. However, as

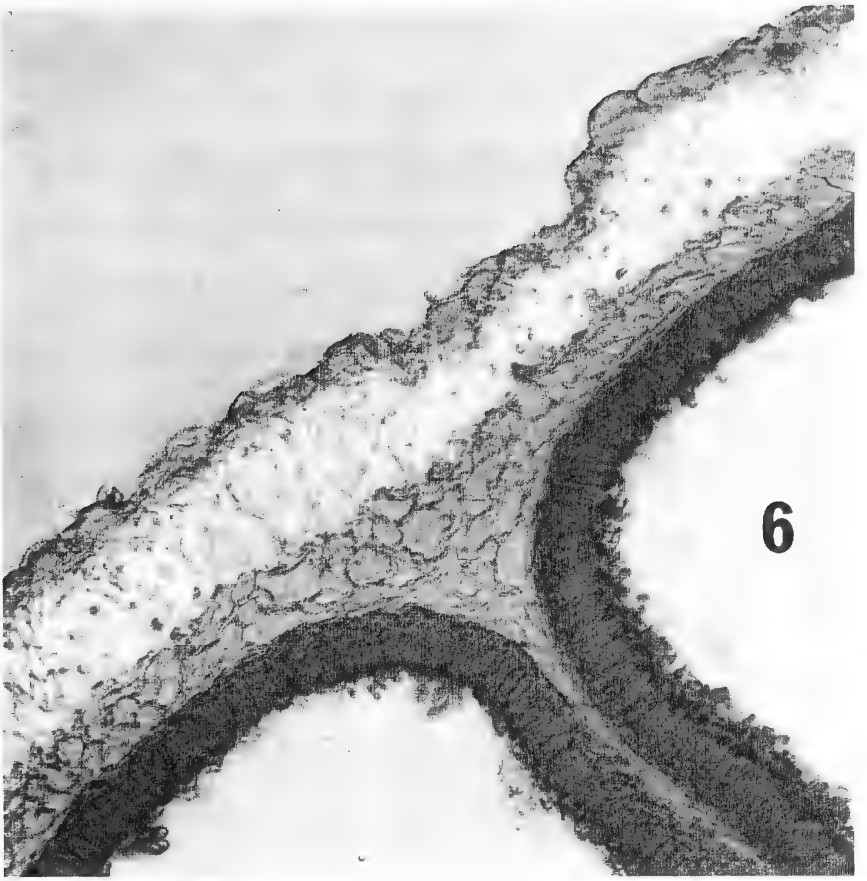


Fig. 6. Tangential section of pileus and lamella (DAOM 215200) 300x mag.

---

redefined by Maas Geesteranus (1983), section *Basipedes* is restricted to greyish species with flattened basal discs, elongated caulocystidia, and cheilocystidia with relatively few excrescences. None have a corticated pileipellis. *Mycena gaultheri* would clearly introduce heterogeneous elements if included in section *Basipedes*, i.e. green and orange pigments, the corticated pileipellis, the regularly diverticulate cheilocystidia, the absence of caulocystidia, and the turbinate basal swelling. In recognizing Maas Geesteranus' revised classification of *Mycena*, we therefore propose the new section, *Testudini*, for *M. gaultheri*. The epithet *Testudini* is derived

from *testudo*, which refers to the corticated pileus and its resemblance to both a tortoise shell and the military formation where Roman soldiers held shields over their heads.

MYCENA SECTION *TESTUDINI SECT. NOV.*

Basidiomata parva. Pileus pellicula gelatinosa, hymenimorpha; cellulae lentiformae, pedicellatae, diverticulatae. Lamellae pseudocollarium formantes. Stipes glabratae; basi turbinatae. Trama pseudoamyloidea. Hyphae fibulatis. Basidia tetraspora. Basidiosporae amyloideae. Cheilocystidia clavata, diverticulata; basi gelatinosae.

Typus: M. gaultheri A. H. Smith

Mycena gaultheri is a minute species, easily overlooked even though quite striking in appearance when closely examined. Its rediscovery was facilitated by a focused, long-term scrutiny of all macrofungi within a defined area. A similar intense inventory of other areas may reveal this fungus is far more common and widespread in western conifer forests than previously thought. However, until its presence is documented by additional collections, it can be considered rare.

ACKNOWLEDGEMENTS: We thank Drs. Joseph Ammirati, James Ginns, & Mr. G. Todd Norvell for constructive reviews, and Drs. Robert Shaffer & Robert Fogel (MICH) for use of herbarium facilities.

REFERENCES

Kühner, R. 1938. LE GENRE *MYCENA* (FRIES). ÉTUDE CYTOLOGIQUE ET SYSTÉMATIQUE DES ESPECES D'EUROPE ET D'AMÉRIQUE DU NORD. Encyl. Mycol. 10. Paul Lechevalier, Paris. 710 p.

Maas Geesteranus, R. A. 1980. Studies in *Mycena* - 15. A tentative subdivision of the genus *Mycena* in the Northern Hemisphere. PERSOONIA 11: 93-120.

Maas Geesteranus, R. A. 1983. Conspectus of the Mycenas of the Northern Hemisphere - 1. Sections *Sacchariferae, Basipedes, Bulbosae, Clavulares, Exiguae*, and *Longisetae*. PROC. K. NED. AKAD. WET. (SER. C) 86: 401-421.

Maas Geesteranus, R. A. 1986. Conspectus of the Mycenas of the Northern Hemisphere - 6. Sections *Polyadelphia* and *Saetulipedes*. PROC. K. NED. AKAD. WET. (SER. C) 89: 159-182.

Norvell, L. L. 1987. The Regular Column: Charting the Chanterelle. MUSHROOM 6(1): 19-21.

Norvell, L. L. 1991. The effects of harvesting on chanterelle productivity in Mt. Hood National Forest, Oregon. MYCOL. SOC. AMER. NEWSLETTER 42(1): 29.

Smith, A. H. 1947. NORTH AMERICAN SPECIES OF *MYCENA*. Univ. Mich. Sci. Ser. Vol. 12. Univ. Mich. Press, Ann Arbor. 521 p.

MYCOTAXON

Volume XLVI, pp. 105-127 January-March 1993

NEW REPORTS ON PARMELIACEAE S.STR. (LICHENIZED ASCOMYCOTINA) FROM SOUTHWESTERN ARGENTINA

Mónica Adler

Departamento de Ciencias Biológicas, FCEN-UBA. Piso 4, Pabellón II,Ciudad Universitaria. 1428 Buenos Aires. Argentina.

Susana Calvelo

Centro Regional Universitario Bariloche. Universidad Nac. del Comahue. C.C. 1336, Bariloche. 8400 Río Negro. Argentina.

ABSTRACT

New records and new data are reported for fifteen species of Parmeliaceae s.str.. **Cetrariastrum americanum** (Mey. & Flot.) Culb. & Culb., **Hypotrachyna sinuosa** (Sm.) Hale and **Parmelinopsis swinscowii** (Hale) Elix & Hale are recorded for the first time from Argentina. **Hypotrachyna densirhizinata** (Kurok.) Hale and **Flavoparmelia ferax** (Müll. Arg.) Hale are confirmed for Argentina. Eight species are reported for the first time from Río Negro and four from Neuquén (Northwestern Patagonian Provinces, Argentina). Ancillary information on **Pannoparmelia angustata** (Pers. in Gaudichaud) Zahlbr. emend Calvelo & Adler is furnished.

INTRODUCTION

This paper is part of more extensive studies aiming to improve the knowledge of the lichen flora of Northwestern Patagonia **Nothofagus** forests (Calvelo & Lorenzo, 1989; Calvelo, 1992, Calvelo & Adler, 1992).

Here we present further results based mainly on new collections of Parmeliaceae s.str. (sensu Hale, 1983; Adler, 1990).

The material for this study was collected in Nahuel Huapi National Park and surroundings, an area of **Nothofagus** forests described previously (Calvelo & Lorenzo, 1989) and in Lanín National Park. Both areas have typical Andean relief and a similar climate, but the vegetation of Lanín National Park includes the only two forests of **Nothofagus alpina** and **N.obliqua** in Argentina and part of an **Araucaria araucana** forest (Cabrera & Willink, 1980; Dimitri, 1959; Hueck, 1978). An isotype of **Pannoparmelia anzioides** (UPS) has been examined.

The collections are deposited in the Centro Regional Universitario Bariloche Herbarium (BCRU), Calvelo´s private herbarium and/or BAFC. Unless otherwise stated the collections were made by Calvelo.

Morphological, anatomical and photographic techniques were described in previous papers (Calvelo & Lorenzo, 1989; Calvelo & Adler, 1992). The chemical constituents were identified by thin layer chromatography (Culberson, 1972; Culberson & Ammann, 1979; Culberson et al., 1981; Elix et al., 1988).

Cetraria chlorophylla (Humb.) Vainio
Lichenes in Sibiria Meridionali collecti. Acta Societatis Pro Fauna et Flora Fennica 13:7. 1896.
Lichen chlorophyllus Humb. Florae fribergensis specimens: 20. Berlín. 1793
Fide Kärnefelt (1987).

Thallus foliose to subfruticose, 2-4 cm across; lobes elongated, irregularly branched, 12-20 mm long, 1.2-1.8 (-2.3) mm wide; flattened lobes

attached by few rhizines, ascending lobes usually channelled and with crisped margins. Upper surface olive brown to dark brown, glossy, smooth to slightly undulate, with linear soralia along the margins, which frequently become labriform at the apices of the lobes. Soredia occasionally becoming corticate. Lower surface brown to pale brown occasionally ivory, glossy, smooth to sulcate; with simple rhizines , up to 1.5 mm long, concolorous with lower surface. Medulla white. Apothecia not seen. Pycnidia typically pediculate in marginal projections (Vobis, 1980); conidia not seen.
Chemistry: Upper cortex K-, no substances detected. Medulla K-, C-, KC-, P-; two fatty acids, major, one of which is protolichesterinic acid.

Specimens examined: ARGENTINA; Prov. Chubut, Lago Futalaufquen, near the port, VII-1957, Kühnemann, BAFC 37050; Prov. Neuquén, Parque Nacional Lanín, Lago Epulaufquen, on **N.alpina**, 17-IV-1992, Calvelo #519. Prov. Río Negro; Bariloche, Arroyo Casa de Piedra, at 800 m a. s. l., on **N.dombeyi**, 3-III-1991, Calvelo #435, BCRU 00289; Llao-Llao, Villa Tacul, on **N.dombeyi**, 13-III-1992, Calvelo #514 and #515, BCRU 00293; on **Austrocedrus chilensis**, 6-IV-1992, Calvelo #518; Cerro Campanario, on **N.dombeyi**, I-1988, L.Ruiz, BAFC 37049; Parque Nacional Nahuel Huapi, Cerro Chalhuaco, NE slope, at 1300 m a. s. l., on **N.pumilio**, 13-V-1989, Calvelo #497; Puerto Blest, road to Lago Frías, on **N.dombeyi**, 14-III-1991, Calvelo #499 and #500; El Foyel, on **N.antarctica**, 21-V-1991, Calvelo #458; Cerro Carbón, S slope, 1050 m a. s. l., on **N.dombeyi**, 2-VIII-1990, Calvelo #485, BCRU 00290; Lago Gutiérrez, path to La Cascada, on **N.dombeyi**, 8-IX-1990, Calvelo #351.

Distribution and Ecology: **C.chlorophylla** has been recorded from Europe, Western North America, Japan, Africa and South America (Tierra del Fuego) (Kärnefelt, 1987) and in Argentina from Chubut Province (Lamb 1958). The present is the first record for Río Negro and Neuquén Provinces.

It seems to be very tolerant to rainfall

since it was collected all along a gradient from 3000 to 1400 mm per year. It was found from 750 m a. s. l. to timberline. This species is common and widespread in **Nothofagus** forests growing on different habitats and phorophytes. It disappears in the surrounding ecotonal forests.
Remarks: **Cetraria chlorophylla** has not been considered by Kärnefelt (1979) in the group of the "brown fruticose Cetrariae". It was also not explicitly included in the key of genera published by one of us (Adler, 1990) because of its unclear taxonomic position. Nevertheless it shares with that group some important features: 1) presence of brown pigments and absence of atranorin in the cortex, 2) pycnidia immersed in marginal projections, 3) presence of protolichesterinic acid in the medulla and 4) dorsiventral, sometimes canaliculate and crisped lobes. For these reasons we consider that this species is very near the "brown fruticose Cetrariae".

Cetrariastrum americanum (Mey. & Flot.) Culberson W. & C.F. Culberson
The Bryologist 84(3):305. 1981.
Evernia americana Mey. & Flot., Nova Acta Acad. Caesareae Leopoldino-Carolinae Germ. Nat. Curiosorum. Suppl. 1, 19:211, 1843.
For a complete list of synonyms see Culberson and Culberson (1981).

Thallus up to 10 cm, with elongated lobes, up to 5 cm long, 1.5-3.8 mm wide, dichotomously to subdichotomously branched. Upper surface whitish grey to greenish grey, uneven, glossy or matt, occasionally with black margins; without isidia and soredia. Lower surface smooth or wrinkled, black at the center, light brown at the apices. Margins densely covered with black, coacervate rhizines, up to 0.8 mm long, profusely divided, forming tufts, few of them present also on lower surface and occasionally on upper surface too; infrequently with few simple and long (up to 1.9 mm) rhizines at the margins of lobe apices. Apothecia not frequent, plane and with thin exciple at maturity, 13-18 mm diam., disc brown to reddish-brown, matt. Ascus cylindric-clavate, 38-52

x 18-22 µm. Ascospores unicellular, 8 per ascus, 12-16 x 4-5 µm. Pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K-, C-, KC-, P-; lichesterinic acid, major, and protolichesterinic acid, minor (confirmed by J.A. Elix).

Specimens examined: ARGENTINA; Prov. Neuquén; San Martín de los Andes, Cerro Las Bandurrias, on **Nothofagus** sp., 22-II-1966, Col:?, BAFC 36739. Prov. Río Negro; El Bolsón, Río Villegas, on **N.antarctica**. 4-IV-1985. Calvelo #456, BCRU 00252; El Foyel, on **N.antarctica**, 8-III-1990, Calvelo #295, BCRU 00298; Bariloche, Arroyo Casa de Piedra, on **N.dombeyi**, 15-VI-1991, Calvelo #463; Parque Nacional Nahuel Huapi, Lago Frías, on trunks, Guibert. Date:?, BAFC 36740. Lago Gutiérrez, on mosses, 3-IV-1992, Calvelo #516.

Distribution and Ecology: **Cetrariastrum americanum** was considered as *"apparently restricted to a small region of Central Chile"* (Culberson and Culberson, 1981). The present is the first report outside this restricted area and the first record from Argentina, with localities in Río Negro and Neuquén Provinces. It also represents the southernmost locality reported for the genus, since previous collections were made north of 38° S. Only two other species of **Cetrariastrum** were cited earlier from Argentina, both in Northwestern areas: **C.cirrhatum** (E.Fr.) Culb. & Culb., from Tucumán, and **C.vexans** Zahlbr. ex Culb. & Culb. from Catamarca (Culberson and Culberson, 1981).

The specimens were epiphytic on **Nothofagus**, growing directly on bark or on mosses ca. 800 m a. s. l.. **C. americanum** seems very tolerant to rainfall (3000 to 1600 mm/ year).
Remarks: In a previous paper one of us (Adler, 1990) used the name **Everniastrum** sensu Sipman (1986) for these lichens. But at present we agree with the criteria used by Culberson & Culberson (1981) for the delimitation of the genus **Cetrariastrum** and we use this name as the correct one (**Everniastrum** Hale is invalid, Culberson & Culberson, 1981).

Flavoparmelia ferax (Müll. Arg) Hale
Mycotaxon 25(2):604. 1986.
Parmelia ferax Müll. Arg. Flora 69:257.1886.
Pseudoparmelia ferax (Müll. Arg.) Hale, Phytologia 28:190. 1974.
Parmelia obversa Stirton, 1899. Trans. Proceed. New Zeal. Inst. 32:76; fide Hale, Smiths. Contr. Bot. 31:31.1976.
Parmelia citrinescens Gyelnik, 1938. Additamenta ad cognitionem Parmelianum,8. Ann. Mycol. 36:271 (type collection: Lago Nahuel Huapi, Puerto Blest, Argentina, Dusen 163 (holotypus BP, isotypes S, US); fide Hale, Smiths. Contr. Bot. 31:31.1976.

Thallus yellowish green, corticolous, rarely saxicolous, well appressed and attached, orbicular, 5-10 cm diam. Upper surface wrinkled. Lobes with pruinose, subrotund to subirregular apices. Medulla white. Lower surface black with a dark chestnut bare rim at the apices of the lobes; densely rhizinate with black simple rhizines. Apothecia up to 5 mm diam., with a chestnut pruinose disc. Ascospores 8 per ascus, 6.5-8 X 13-16 µm. Pycnidia laminal, immersed. Conidia cylindric, straight to slightly fusiform, 6-8 µm long.
Chemistry: Upper cortex K-, usnic acid. Medulla K- or K+ light orange-yellow, C-, KC+ orange-yellow (darker than K+), P+ orange; physodalic acid, major, and protocetraric acid, minor.

Specimens examined: ARGENTINA, Prov. Río Negro. Bariloche, Km 9.5 Ruta a Llao-Llao, on **Acer pseudoplatanus**, 22-XI-1991, Adler & Calvelo, Calvelo #552, #502, BCRU 00302; BAFC 37040, 37041. Parque Nacional Nahuel Huapi, Cerro Chalhuaco, 1400 m a. s. l., on rock, 13-V-89, Calvelo #560.

Distribution and Ecology: Hale (1976c) restricted the distribution of **Flavoparmelia ferax** to Australia and Chile and did not mention it from Argentina, even when in the same paper he considered **Parmelia citrinescens** Gyelnik (type collection from Puerto Blest, Argentina), as a synonym of **F.ferax**. Based on this consideration

we assume that the species was already known from the area presently under study and we confirm its presence here. The specimens examined here are the first collections after those made by Dusén.
F.ferax is considered corticolous (Hale, 1976c), but one of our collections is from rocks, above timberline. It was not recorded on native **Nothofagus** or ecotonal forests. However its presence on the exotic European tree **Acer pseudoplatanus**, in an urban development (where it is so frequent as to be possible to find more than twenty thallus per phorophyte) is very interesting. Even though there are numerous other specimens of native as well as exotic trees in the same area, in none of them was **F.ferax** found. This is particularly noteworthy because this species has a circumantarctic distribution and **A.pseudoplatanus** is a boreal tree.
Remarks: The conidia of the genus **Flavoparmelia** were characterized as bifusiform (Hale, 1986). The examination of the present collections demonstrate that also cylindrical to slightly fusiform conidia may occur in the genus.

Flavoparmelia haysomii (Dodge) Hale
Mycotaxon 25(2):605. 1986.
Parmelia haysomii Dodge, Nova Hedwigia 15:293. 1968.

Thallus saxicolous, moderately attached, pale greenish-yellow, dark-bluish grey in dead or moribund parts, ca. 5 cm diam. Lobes subirregular to sublinear, 1-3 mm wide. Upper surface dactylate, the dactyls first inflate, later rupturing and forming gas exchange pores or crumbling but not really becoming sorediate. Medulla white. Lower surface black, moderately rhizinate with simple concolorous rhizines. Apothecia and pycnidia not seen.
Chemistry: Upper cortex K-, usnic acid. Medulla K-, C-, KC+ light yellow, P+ light orange; protocetraric acid, major and caperatic acid, major.

Specimens examined: ARGENTINA. Prov. Río Negro, Bariloche Cerro Leones, North slope, on rock,

Vobis 13-VI-1986, Calvelo #553, BCRU 00304.

Distribution and Ecology: **Flavoparmelia haysomii** has a circumantarctic distribution: Australia (Filson, 1982) (ca. 40° S), subantarctic, Macquarie Islands, the type locality (Dodge, 1968), (ca. 55° S). In Argentina this is the first time that it is recorded from Río Negro Province (41° S) but its distribution extends North up to Buenos Aires (ca. 37° S) (Adler, 1989) and Salta (ca. 25° S) (Adler, unpublished data).
Remarks: **F. haysomii** (Southern Hemisphere, caperatic acid as accessory substance) is very near to **F.baltimorensis** (Northern Hemisphere, gyrophoric acid as accessory substance, never caperatic acid) (Hale, 1976c). Both species are saxicolous, dactylate, and with protocetraric acid in the medulla.

Hypotrachyna brevirhiza (Kurok.) Hale
Smiths. Contr. Bot. 25:26. 1975.
Parmelia brevirhiza Kurok., in Hale and Kurokawa, Contr. US Nat´l Herb.: 166.1964.

Thallus pale grey to greenish-grey, up to 6 cm diam. Lobes sublinear to subirregular, (1-) 2-5 mm wide. Upper surface plane, sometimes covered with white pruina. Pustulate-sorediate, soralia apical, submarginal, eventually laminal; apices of lobes becoming revolute when covered by large soralia; soredia powdery to granulose. Medulla white. Lower surface black with a light brown margin at the lobe tips; densely rhizinate, rhizines black, mostly dichotomously branched. Apothecia, up to 4 mm diam.; amphithecium sorediate, disc reddish-brown. Ascospores 4-6 x 6.5-10.5 µm. Pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K+ yellow turning red, salazinic acid, major.

Specimens examined: ARGENTINA. Prov. Neuquén. San Martín de los Andes, road to Lago Epulaufquen, on **N.alpina**, 17-IV-1992, Calvelo #554. Prov.Río Negro. Bariloche, Arroyo Casa de Piedra, on **N.dombeyi**, 3-III-1991, Calvelo #546; on **Schinus patagonicus**, 3-III-1991, Calvelo #547;

on rock, 21-IX-1991, Adler , Calvelo #548, BAFC 37046. Km 9.5 Ruta a Llao-Llao, on **Quercus borealis**, 14-VI-1991, Calvelo #460; on **Embothrium coccineum**, 14-VI-1991, Calvelo #461; on **Acer pseudoplatanus**, 14-VI-1991, Calvelo #462; #549, #550, BCRU 00301; 21-XI-1991, Adler, BAFC 37047. Parque Nacional Nahuel Huapi, Llao-Llao, path to Lago Escondido, on rock, 29-XI-1991, Adler & Calvelo, Calvelo #551.

Distribution and Ecology: Pantropical and in southern Chile and Argentina (Hale, 1975). This is the first record for Río Negro and Neuquén Provinces. In the area of study it was collected on rock and on a great variety of native as well as exotic phorophytes, always at the lowest altitudes (ca. 800 m a. s. l.).
Remarks: The presence of apothecia of **H. brevirhiza** is reported as very rare (Hale, 1975) but ca. one third of our collections show well developed apothecia.

Hypotrachyna densirhizinata (Kurok.) Hale
Smiths. Contr. Bot. 25:31.1975.
Parmelia densirhizinata Kurokawa,in Hale & Kurokawa, Contr. US Nat´l Herb. 36:171. 1964.

Thallus foliose, corticolous, pale grey, 5-10 cm diam. Lobes linear, elongate, 0.8-5 mm broad, subdichotomously divided. Upper surface plane. Medulla white. Lower surface black, moderately rhizinate. Rhizines black, densely dichotomously branched, extending beyond the margins. Apothecia not seen. Pycnidia frequent. Conidia bifusiform, 5-7 µm long.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K-, C-, KC+ pink turning orange; alectoronic acid, major, α-collatollic acid, major, and four minor spots, pale after charring.

Specimens examined: ARGENTINA; Río Negro,Parque Nacional Nahuel Huapi, Lago Gutiérrez,near La Cascada, on **N.dombeyi**,8-IX-1990, Calvelo#399; Puerto Blest, road to Lago Frías, on **N.dombeyi**, 26-IV-1991,Calvelo #441.Puerto Alegre, on **N.dombeyi**, 14-III-91, Calvelo #442. Llao-Llao, Villa Tacul, on **N.dombeyi**, 6-IV-1992, Calvelo #555.

Distribution and Ecology: **Hypothachyna densirhizinata** is widely distributed in Southern and Central America (Hale & Kurokawa, 1964), Southern United States, Mexico and Africa (Hale, 1975, Krog & Swinscow, 1979). Hale (1975) reports this species for Argentina based on a collection kept at UPS (Lamb 6003) without locality. This is the first explicit mention of the species for Río Negro Province.

This species grows in humid habitats. Specimens were found only on bark, although Hale (1975) recorded it also as saxicolous.

Hypotrachyna sinuosa (Sm.) Hale
Smiths. Contr. Bot. 25:63. 1975.
Lichen sinuosus Smith, English Botany 29:2050.1809.
For a complete list of synonyms see Hale (1975).

Thallus appressed, orbicular, up to 6 cm diam. Lobes sublinear, 0.8-3.2 mm wide. Upper surface yellowish-green, plane. Sorediate, soralia subterminal, capitate, sometimes pustular-sorediate. Lower surface black; densely rhizinate up to the margins. Apothecia rare, 2-3 mm diam., immature. Pycnidia not seen.
Chemistry: Upper cortex K-, usnic acid. Medulla K+ yellow turning red, P+ orange, salazinic acid, major, and norstictic acid, minor.

Specimens examined: ARGENTINA. Prov. Río Negro. Bariloche, Pampa de Huenuleo, on **Anarthrophyllum rigidum**, 4-II-1989, Brion, Calvelo #401. Arroyo Casa de Piedra, on **Maytenus boaria**, 12-V-1991, Calvelo #556; on **Schinus patagonicus**, 12-V-1991, Calvelo #557. Km 9.5 Ruta a Llao-Llao, on **Acer pseudoplatanus**, 28-V-1990, Calvelo #558; on **Quercus borealis**, 15-II-1991, Calvelo #440. Parque Nacional Nahuel Huapi, Llao-Llao, on rock, 29-IX-1991, Adler & Calvelo, Calvelo #559. Cerro Carbón, S slope, 1050 m a. s. l., on **N.pumilio**, 2-V-1987, Calvelo #32.

Distribution and Ecology: Cosmopolitan (Hale, 1975). This is the first record for Argentina. Corticolous, on diverse phorophytes, native as

well as exotic ones, rarely saxicolous; fairly common in this area, it is more frequently found in ecotonal forests.

Melanelia subglabra (Räs.) Esslinger
Mycotaxon 7(1)48.1978.
Parmelia subaurifera var. *subglabra* Räs., Ann. Bot. Soc. Zool. -Bot. Fenn. "Vanamo" 2:19.1932.

Thallus corticolous, pale olive brown, appressed, ca. 5 cm diam. Upper surface plane. Lobes subrotund to subirregular 3-5 mm wide, more or less imbricate. Marginal soralia punctiform to capitate, frequently coalescent; laminal soralia convex globular. Medulla white. Lower surface pale brown to ivory, densely rhizinate with simple hyaline rhizines except in a papillate rim at the apices of the lobes. Apothecia and pycnidia not seen.
Chemistry: Upper cortex K-, NO_3H-, no substance detected. Medulla K-, C+ pink; gyrophoric acid, major, unknown T-9, major .

Specimens examined: ARGENTINA. Prov. Río Negro; Parque Nac. Nahuel Huapi, Cerro López, on **N.pumilio**, at 1000 m a. s. l.,4-IV-1987,Calvelo #50.

Distribution and Ecology: **Melanelia subglabra** is known from Australia, Chile and Argentina (Esslinger, 1977). In Argentina it was previously collected from Tierra del Fuego (type collection) and Neuquén Province.
This is the first record for Río Negro Province.

Pannoparmelia angustata (Pers. in Gaudichaud) Zahlbruckner emend. Calvelo & Adler., Symb. Sin. 3 Lich.: 195. 1930. Mycotaxon 43: 495. 1992.
Parmelia angustata Pers. in Gaudichaud, Voy. Uranie Bot.: 195.1827.
Pannoparmelia anzioides Darb. Wissen. Ergeb. Swed. Sudpolar-Exped. 1901-1903. (Ed. O. Nordenskjold) 4(2). P.A. Norstedt, Stockohlm. p 11. 1912. Isotype at UPS!.
A complete list of synonyms in Galloway (1978).

A redescription of **Pannoparmelia angustata**

has recently been published (Calvelo & Adler, 1992). We have now examined an isotype of **P.anzioides** from the presumptively lost Skottsberg collection (Fig.1). Additional samples from Lanín National Park have also been studied. These observations confirm the synonymy between **P.angustata** and **P.anzioides**. The distribution in Argentina is here extended to the North (new to Neuquén Province).

Specimens examined: ARGENTINA. Tierra del Fuego, Ushuaia, on bark of **N.betuloides**, 1902, col. Skottsberg, Isotypus (Fragm. typi scripsit. Skottsberg), (UPS) (L-21137) 56511. Prov. Neuquén. Parque Nacional Lanín, near Lago Epulaufquen, on **N.dombeyi**, 17-IV-1992,Calvelo #542.

Parmelia cunninghamii Crombie
Journ. Linn. Soc. of London 15:228. 1876.
Parmelia brownii Dodge, Nova Hedwigia 19:449. 1970.

Thallus foliose, corticolous or saxicolous; up to 14 cm diam.; lobes contiguous, roundish to elongate, 3-6 mm wide, margins ascending, undulate. Upper surface greenish-grey, plane to wrinkled or foveolate. Pseudocyphellae marginal and laminal, effigurate, 0.4-0.8 mm, separate. Sorediate, marginal soralia initially orbicular later confluent, becoming linear; laminal soralia mostly on older parts of the thallus, orbicular, 0.7-1.2 mm diam; soredia whitish, granular. Lower surface black and densely rhizinate, frequently brown and without rhizines at the apices; rhizines black, simple to squarrose, 1-2.4 mm long. Apothecia rare, subpedicellate, 7-16 mm diam.; amphithecium pseudocyphellate; disc plane, pale brown. Ascospores 11-14 x 8-9.5 µm. Pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K+ yellow turning red, salazinic acid, major, and lobaric acid, minor.

Specimens examined: ARGENTINA; Prov. Río Negro; Bariloche, Arroyo Casa de Piedra, at 780 m a. s. l., on **N.dombeyi**, 3-III-1991, Calvelo #536, BCRU 00297; path to Refugio Frei, on **N.dombeyi**, 22-

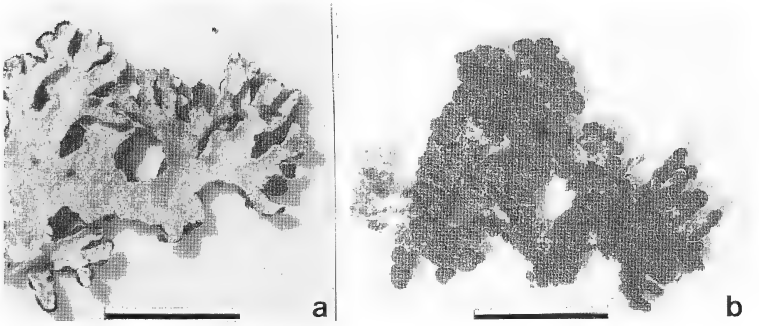


Fig.1 a-b: Thallus of **Pannoparmelia anzioides** collected by Skottsberg in 1902 (isotype) scale: 1 cm. See original manuscript of envelope (Fig. 1 c).

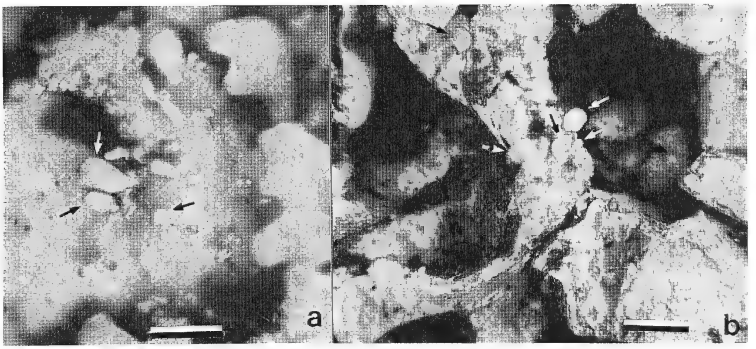


Fig.2 Detail of lobules (arrows). a: **Parmelia saxatilis** (Collection #523). b: **Parmelia sulcata** (Collection #531). Scale 1 mm.

XI-1991, Adler, Calvelo #525, BAFC 37058; Llao-Llao, Lago Moreno, on **N.dombeyi**, 30-IX-1990, Calvelo #406; Parque Nac. Nahuel Huapi, Cascada Los Alerces, on mosses, 16-IV-1989, Calvelo#393; Rápidos del Río Manso Superior, on **N.dombeyi**, I-1988, N.Scutari, Calvelo #405; Puerto Blest, path to Arroyo Los Cántaros, on **N.dombeyi**, 13-III-1991, Calvelo #524; on **Amomyrtus luma**, 13-III-1991, Calvelo #538; Lago Frías, Puerto Alegre, on **N.dombeyi**, disturbed area, 14-III-1991, Calvelo #539; Lago Gutiérrez, on **N.dombeyi**, I-1988, N.Scutari, Calvelo #396 & #402.

Distribution and Ecology: Widespread in Austral regions (Hale, 1987), in South America known from Chile and Argentina. This is the first record for Río Negro Province.

The specimens were epiphytic on bark or mosses, in **Nothofagus** forests, in shady to medium exposed sites.

Parmelia protosulcata Hale
Mycotaxon 16(1):162. 1982.

Thallus foliose 2-4 cm diam.; lobes elongated, almost dichotomously branched, 1.5-2.5 mm wide. Upper surface whitish-grey with black margins, glossy, smooth at the apices, deeply fissured in older parts. Pseudocyphellae elongate, 0.3-0.5 mm. Sorediate, with apical soralia. Lower surface black with brown apices, rhizinate; rhizines black, mostly furcate, few simple. Apothecia and pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K-, C-, P+ orange; fumarprotocetraric acid, major, and lobaric acid, minor.

Specimen examined: ARGENTINA. Prov. Río Negro, Parque Nacional Nahuel Huapi, Puerto Blest, path to Arroyo Los Cántaros, on **N.dombeyi**, 13-III-1991, Calvelo #537.

Distribution and Ecology: Austral: New Zealand, Southern South-America (Hale, 1982). Common in **Nothofagus** forests in Tierra del Fuego (Hale, 1982). This is the first record for Río Negro Province. Rare in the area of the present study.

Remarks: Although most of the collections correspond to the protocetraric acid chemotype (Hale, 1982), the specimen presently studied belongs to the rare fumarprotocetraric acid chemotype.

Parmelia saxatilis (L.) Acharius
Methodus qua omnes detectos lichenes, Stockholm: 204. 1803.
For a complete list of synonyms see Hale (1987).

Thallus foliose, closely to loosely attached to bark or rock, up to 18 cm diam.; lobes shortly elongated, contiguous and crowded, 1.5-4 mm wide. Upper surface continuous to cracked on older lobes, plane to foveolate. Pseudocyphellae effigurate, 0.4-0.9 mm long, laminal and marginal, frequently confluent, forming a reticulum and/or cracks on the upper surface. Isidiate, isidia marginal and laminal, formed all along the pseudocyphellae, terete, simple, concolorous with the thallus, brown to black apically, 0.05-0.2 mm diam., 0.7 mm high, sparse near the lobe apices, dense on older parts. Occasionally suberect phyllidia-like structures develop among isidia (Fig.2-a). Lower surface black, densely rhizinate; rhizines simple to furcate, 1-2 mm long. Apothecia rare, substipitate, 4-7 mm diam., disc reddish-brown, amphithecium isidiate. Ascospores 12-16 x 6-10 µm. Pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K+ yellow turning red, salazinic acid, major.

Specimens examined: ARGENTINA. Prov. Río Negro, Bariloche, Arroyo Casa de Piedra, 790 m a.s.l., on mosses/rock, **N.dombeyi** forest, 21-IX-1991, Adler & Calvelo, Calvelo #522. 870 m a.s.l., on mosses/rock, 12-IV-1991, Calvelo #523. SPAIN. Lérida, Vall Clara, Coll de Prades, 1000 m a. s. l., on mosses/rock, **Quercus borealis** forest, 6-IX-1976, Vobis #027b.

Distribution and Ecology: Cosmopolitan (Hale, 1987). Collections were made on rocks covered by

mosses, in shady habitats.

The present is the first record for Río Negro Province.

Remarks: The specimens examined from Argentina differ from the description of the species given by Hale (1987), by the presence of phyllidia-like structures among the isidia (Fig.2-a), a feature also mentioned for some collections from Tierra del Fuego (Stenroos, 1991). They are considered here as folioles, and since they appear occasionally in other species of **Parmelia** s.str. (Hale, 1987), we include them within the variability of **P.saxatilis**.

Parmelia sulcata Taylor
Lichens. In J.T. Mackay, Flora Hibernica, Dublin: 145. 1836.
For a complete list of synonyms see Hale (1987).

Thallus foliose, closely attached to bark or rock, up to 18 cm diam.; lobes elongate, sublinear, 1.5-2.5 (-3) mm wide; margins entire, turning down. Upper surface without or with varying amounts of pruina, particularly at the apices; greyish mineral white, sometimes with black margin; plane to foveolate, cracked on older parts. Pseudocyphellae laminal to marginal, effigurate, 0.4-1.2 mm, separate. Sorediate, soralia derived from pseudocyphellae, marginal and laminal, along ridges, few orbicular, mostly linear, becoming confluent, forming a reticulum, covering entirely the thallus surface of older lobes. Soredia white turning greyish brown with age. Occasionally soredia of older lobes become corticate forming dorsiventral, suberect, phyllidia-like lobules (Fig.2-b). Lower surface entirely black, densely rhizinate; rhizines black simple to squarrose, 1-2 mm long. Apothecia and pycnidia not seen.
Chemistry: Upper cortex: K+ yellow, atranorin. Medulla K+ yellow turning red, salazinic acid, major.

Specimens examined: ARGENTINA. Prov. Chubut, Parque Nacional Los Alerces, Lago Kruger, VII-1957, Kühnemann, Calvelo #400; Prov. Río Negro, Bariloche, Arroyo Casa de Piedra, on **N.dombeyi**,

3-III-1991, Calvelo #533, BCRU 00296; Llao-Llao, near the hotel, on rocks, 29-XI-1991, Adler & Calvelo, Calvelo #527, #534; Parque Nacional Nahuel Huapi, Cerro López, 1210 m a.s.l., on **N.pumilio**, 4-IV-1987, Calvelo #89; Cerro Bella Vista, W slope, 1350 m a. s. l., on **N.pumilio**, 27-I-1990, Calvelo #424; Cerro Catedral, path to Frei, 900 m above sea level, on **N.dombeyi**, 8-XII-1986, Calvelo #90; 1100 m a. s. l., on **N.pumilio**, 17-III-1991, Calvelo #531, BCRU 00300; 1200 m a.s.l., 17-I-1991, Calvelo #529, #534; Cerro Chalhuaco, 1150 m a.s.l., on **N.dombeyi**, 5-XI-1991, Calvelo #532. Tierra del Fuego, Río Apen, I-1989, L. Ruiz, Calvelo #404.

Distribution and Ecology: **Parmelia sulcata** is widespread and cosmopolitan (Galloway, 1985 and Hale, 1987). This is the first record for Nahuel Huapi National Park.

This species is better represented at higher altitudes, on deciduous **Nothofagus** forests.

Remarks: The studied specimens show mainly three features not included in the description of the species made by Hale (1987): 1) presence of pruina on the upper surface, 2) soredia becoming greyish-brown with age, 3) formation of phyllidia-like structures (Fig.2-b) on older parts of the thallus. Since these characteristics may appear occasionally in other species of **Parmelia** s.str. they are considered here as part of the intraspecific variability of **P. sulcata**.

Parmelinopsis swinscowii (Hale) Elix & Hale Mycotaxon 29:243. 1987.
Parmelia swinscowii Hale, Phytologia 27:4. 1973.
Parmelina swinscowii (Hale) Hale, Smiths. Contr. Bot. 33:48. 1976.
Hypotrachyna swinscowii (Hale) Krog & Swinscow, Lichenologist 19:420.1987.

Thallus foliose, 5-20 cm diam., saxicolous or muscicolous, pale grey, darker in old or moribund parts. Lobes narrow, 0.5-3 mm wide, subdichotomously branched, with acute apices and black margin. Marginal cilia black, up to 1.5 mm long, simple, furcate, squarrose or subdicho-

tomously divided. Upper surface fragile, cracked in older parts, flaking off at sorediate parts. Soralia terminal or subterminal, frequently extending laminally, with granulose soredia mixed with pieces of eroded cortex. Medulla white. Lower surface black, frequently brown at the lobe apices, moderate to sparsely rhizinate; rhizines black, simple, furcate, squarrose to irregular or subdichotomously branched. Apothecia and pycnidia not seen.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K+ yellow turning red, C-, P+ yellow, salazinic acid, major, lobaric acid minor and a minor substance, pale after charring.

Specimens examined: ARGENTINA. Prov. Río Negro. Bariloche. Arroyo Casa de Piedra, on rock, 21-IX-1991, Calvelo & Adler, BAFC 37038 & 37039, Calvelo #504. Llao-Llao, near the hotel, on rock, 29-IX-1991, Adler & Calvelo, Calvelo #503.

Distribution and Ecology: **Parmelinopsis swinscowii** is known from Chile (Hale, 1973, 1976b), Africa (Krog & Swinscow, 1979), Colombia (Sipman, 1980), New Zealand (Elix et al., 1991). This is the first record for Argentina.
It grows on rocks covered by mosses.

Parmotrema reticulatum (Taylor) Choisy
Bull mens. Soc. linn. Lyon 21:175.1952.
Parmelia reticulata Taylor in Mack., Fl. Hibern. 2:148.1836.
Rimelia reticulata (Taylor) Hale & Fletcher, Bryologist 93(1):28. 1990; with a complete list of synonyms.

Thallus grey, 5-20 cm diam., loosely attached on bark. Lobes 3-6 mm broad, frequently laciniate; ciliate, cilia black, mostly simple or furcate, up to 2 mm long. Upper surface plane to undulate, faintly reticulate to diffusely maculate, partially to almost completely cracked (depending on collections); sorediate, soralia terminal or subterminal often spreading laminally, originating in a pustular manner; the soredia coarse mixed with pieces of eroded cortex. Medulla white, often exposed by flaking off of the upper

cortex. Lower surface completly black, with black rhizines or forming a broad brown sparsely rhizinate rim, sometimes mottled with ivory parts.
Chemistry: Upper cortex K+ yellow, atranorin. Medulla K+ yellow turning red, salazinic acid, major.

Specimens examined: ARGENTINA. Prov. Neuquén, San Martín de los Andes, 22-IX-1966, Ranalli & Diehl, on **Nothofagus** sp., BAFC 37042. Prov. Río Negro, Parque Nacional Nahuel Huapi, Lago Gutiérrez, path to Refugio Frei, 22-IX-91, Adler, on **N. dombeyi**, BAFC 37044, Calvelo #489; Llao-Llao, path to Lago Escondido, on rocks, 22-IX-1991, Adler & Calvelo, Calvelo #487, #488; on **Luma apiculata**, 22-III-1990, Calvelo #512. Puerto Blest, path to Lago Frías, on **N.dombeyi**, 13-III-1991, Calvelo #513. Río Manso Superior, on **N.dombeyi**, 3-II-1988, Calvelo #492. El Foyel, on **N.dombeyi**, 5-X-1990, Calvelo #490. Bariloche, Km.9.5 Ruta a Llao-Llao, on **Acer pseudoplatanus**, 22-XI-1991, Adler, BAFC 37044,BCRU 00299. El Bolsón, Río Manso, on **Nothofagus** sp., 4-IV-1986, Calvelo #493.

Distribution and Ecology: "*Pantemperate, pansubtropical, one of the commonest foliose lichens in the world*" (Hale & Fletcher, 1990). It is also one of the commonest lichens in Argentina; nevertheless this is the first record for Río Negro and Neuquén Provinces.

The specimens collected for this study were corticolous but the species may also be saxicolous.
Remarks: **Parmotrema reticulatum** is an extremely variable species. Recently it has been transfered to the new genus **Rimelia** (Hale and Fletcher, 1990): the authors establish in the diagnosis that it has "*...lobis...superne distincte macu-lato-reticulatus...*", and further they considered this character as quite constant: "*...The surface is more or less uniformly white reticulate maculate, and at maturity regular fissures develop along the maculate lines... The lobe tips are either smooth and continuous or white-maculate spotted, never*

reticulate-maculate."

None of the specimens from Patagonia studied in the present survey showed the "typical" reticulate-maculate pattern but a more diffuse one, which could also be absent in some parts. Studies on collections from diverse habitats from Buenos Aires Province confirmed the great variability in various features, including notorious differences in the pattern of maculation (Adler, unpublished data). Furthermore field observations in Buenos Aires suggest that the variability is correlated with ecological factors, as also pointed out by Krog & Swinscow (1981) for East Africa: "*Specimens growing in rather dry sites exposed to high light intensity tend to become coriaceous, have weakly developed maculae, ...while specimens in moist, shady habitats usually are membranaceous...and have well developed maculae*". The same variability has been observed in collections of **Parmotrema cetratum** (Adler, unpublished data).

Since the reticulate-maculate pattern is the most important feature to segregate this genus, and as it apparently depends on ecological factors, we prefer to use here the genus name **Parmotrema** until further studies are developed.

ACKNOWLEDGEMENTS

We want to thank Drs. J.E. Wright, G. Vobis and I. Gamundi for useful discussions during the development of the work and for corrections to the manuscript; G. Degelius (GB) and F. Norris (BISH) for important assistance in searching Skottsberg collections and UPS for the loan of an isotype of **Pannoparmelia anzioides**. This work was undertaken with financial support from CONICET, Fundación Antorchas and Secretaría de Investigación of Universidad Nacional del Comahue.

REFERENCES

Adler, M. 1989. Two new species in Parmeliaceae (Lichenized Ascomycotina) and new records for Argentina. Mycotaxon 35:399-404.

Adler, M. 1990. An artificial key to the genera of the Parmeliaceae (Lichens, Ascomycotina). Mycotaxon 38: 331-347.

Cabrera, A. & A. Willink. 1980. Biogeografía de América Latina. Monografía 13. OEA.

Calvelo, S. 1992. Novedades para la Flora Liquénica del Parque Nacional Nahuel Huapi y sus alrededores (Argentina). Bol.Soc.Argent.Bot. 28(1-2):00-00

Calvelo, S. & M.Adler. 1992. **Pannoparmelia anzioides** a taxonomic synonym of **Pannoparmelia angustata** (Parmeliaceae, Lichenes). Mycotaxon 43: 487-498.

Calvelo,S. & L.Lorenzo. 1989. Noteworthy corticolous lichens in **Nothofagus** forests, North-Western Patagonia.Mycotaxon 34(2): 655-665.

Culberson, C. F.. 1972. Improved conditions and new data for the identification of lichen products by standardized thin layer chromatographic method. Journ. Chromatogr. 72: 113-125.

Culberson, C.F.& K.Ammann. 1979. Standardmethode zur Dünnschichtchromatographie von Flechtensubstanzen. Herzogia 5: 1-24.

Culberson, W. & C. Culberson. 1981. The genera **Cetrariastrum** and **Concamerella** (Parmeliaceae): a chemosystematic synopsis. The Bryologist 84(3): 273-314.

Culberson, W., C. Culberson & A. Johnson. 1981. A standardized TLC analysis of β-orcinol depsidones. The Bryologist 84:16-29.

Dimitri, M. 1959. Aspectos Fitogeográficos del Parque Nacional Lanín. Anales de Parques Nacionales VIII. Buenos Aires.

Dodge, C.W. 1968. Lichenological notes on the Flora of Antarctic Continent and the Subantarctic Islands. VII and VIII. Nova Hedw. 15:285-332.

Elix, J., J.Johnston & J. Parker. 1988. A computer program for the rapid identification of lichen substances. Mycotaxon 31:89-99.

Elix, J., B. Polley, W. Nelson & C. West. 1991. Additional lichen records from New Zealand. 5. **Parmelinopsis swinscowii** (Hale) Elix & Hale. Australasian Lichen-

ological Newsletter, 29:4.
Esslinger, T. 1977. A chemosystematic revision of the brown Parmeliae. Journ. Hattori Bot. Lab. 42:1-211.
Filson, R. 1982. A contribution on the genus **Parmelia** (Lichens) in Southern Australia. Austr. Journ. Bot. 30: 511-582.
Galloway, D. 1978. **Anzia** and **Pannoparmelia** (Lichenes) in New Zealand. New Zealand Jour. Bot. 16:261-270.
Galloway, D. 1985. Flora of New Zealand: Lichens. Hasselberg, Government Printer, Wellington, New Zealand.
Hale, M.E. 1973. New Parmeliae from Africa. Phytologia 27:1-6.
Hale, M.E. 1975. A Revision of the lichen genus **Hypotrachyna** (Parmeliaceae) in tropical America. Smiths. Contr. Bot. 25:1-73.
Hale, M.E. 1976a. Synopsis of a new lichen genus, **Everniastrum** Hale (Parmeliaceae). Mycotaxon 3(3): 345-353.
Hale, M.E. 1976b. A monograph of the lichen genus **Parmelina** Hale (Parmeliaceae). Smiths. Contr. Bot. 33:1-60.
Hale, M.E. 1976c. A monograph of the lichen genus **Pseudoparmelia** Lynge (Parmeliaceae) Smiths. Contr. Bot. 31:1-62.
Hale, M.E. 1982. A new species of **Parmelia** (Lichenes) with protocetraric acid. Mycotaxon 16(1):162-164.
Hale,.M.E. 1983. The Biology of Lichens. 3rd ed. Edwards Arnold. London.
Hale, M.E. 1986. **Flavoparmelia**, a new genus on the lichen family Parmeliaceae (Ascomycotina). Mycotaxon 25 (2): 603-605.
Hale, M.E. 1987. A Monograph of the lichen genus **Parmelia** Acharius sensu stricto (Ascomycotina: Parmeliaceae). Smiths. Contr. Bot. 66:1-51.
Hale, M.E. & A. Fletcher. 1990. **Rimelia** Hale & Fletcher, a new lichen genus (Ascomycotina: Parmeliaceae). The Bryologist 93(1):23-29.
Hale, M.E. & S. Kurokawa. 1964. **Parmelia** subgenus **Parmelia**. Contr. US Nat´l Herb. 36:121-191, 9 plates.
Hueck, K. 1978. Los bosques de Sudamérica. Soc.

Alemana de Coop.Tec. Eschborn, Alemania.
Kärnefelt,I. 1979. The brown fruticose species of Cetraria. Opera Botanica 46:1-150.
Kärnefelt, I. 1987. **Cetraria** (Parmeliaceae) and some related genera on the African continent. Bothalia 17 (1): 45-49.
Krog, H. & T. Swinscow. 1979. **Parmelia** subgenus **Hypotrachyna** in East Africa. Norw. Journ. Bot. 26:11-43.
Krog, H. & T. Swinscow. 1981. **Parmelia** subg. **Amphigymnia** (Lichens) in East Africa. Bull. Brit. Mus. Natl. Hist. (Bot.) 9(3):143-339.
Lamb, I.M.. 1958. La vegetación liquénica de los Parques Nacionales Patagónicos. Anales de Parques Nacionales; VII. Buenos Aires.
Sipman, H. 1980. Studies on Colombian cryptogams. X. The genus **Everniastrum** Hale and related taxa (Lichenes). Proc. Koninklijke Nederl. Akad van Wetenschapp., Ser. C. 83(3): 333-354.
Sipman, H. 1986. Notes on the lichen genus **Everniastrum** (Parmeliaceae). Mycotaxon 26: 235-251.
Stenroos, S. 1991. The lichen genera **Parmelia** and **Punctelia** in Tierra del Fuego. Ann. Bot. Fennici 28:241-245.
Vobis, G. 1980. Bau und Entwicklung der Flechten-Pycnidien und ihrer Conidien. Bibliotheca Lichenologica 14.

MYCOTAXON

Volume XLVI, pp. 129-134 January-March 1993

TALAROMYCES INDIGOTICUS, A NEW SPECIES FROM SOIL

Masaki TAKADA[1] and Shun-ichi UDAGAWA[2]

1 *Institute for Life Science Research, Asahi Chemical Industry Co., Ltd., 632-1, Mifuku, Ohito-cho, Tagata-gun, Shizuoka 410-23, Japan*
2 *Nodai Research Institute, Tokyo University of Agriculture, 1-1-1, Sakuragaoka, Setagaya-ku, Tokyo 156, Japan*

SUMMARY

A new species, *Talaromyces indigoticus* Takada et Udagawa (anam. *Penicillium indigoticum* Takada et Udagawa), isolated from soil in Japan and Nepal, is described and illustrated. It is characterized by yellow to orange ascomata, ellipsoidal, spinose, blue-pigmented ascospores and short biverticillate or monoverticillate penicilli.

Key Words - *Talaromyces indigoticus*; *Penicillium indigoticum*; blue-pigmented ascospores; soil; Nepal; Japan

During the course of an investigation of soil-borne Ascomycetes in Japan and Nepal, a hitherto undescribed fungus of *Talaromyces* C. R. Benjamin (Trichocomaceae) was repeatedly encountered. It is described herein as a new species.

Talaromyces indigoticus Takada et Udagawa, sp.nov. (Figs. 1, 2)

Stat. Anam. *Penicillium indigoticum* Takada et Udagawa, anam. sp.nov.

Coloniae in agaro Czapekii restrictae, floccosae, tenues, laxitextae, ochraceae vel succineae; reversum

primo miniatum vel rubrum, deinde roseobubalinum. Coloniae in agaro "Czapek-Yeast Autolysate (CYA)" paulo effusae, floccosae, planae, constantes ex mycelio basali coacto tenuiter et ascomatibus abunde formantibus; conidiogenesis profusa; reversum corallinum, deinde rubrum vel sanguineum. Coloniae in agaro pultis avenae effusae, floccosae, planae, constantes ex mycelio basali coacto tenuiter et ascomatibus abunde formantibus; conidiogenesis sparsa; reversum stramineum vel ochraceum.

Ascomata superficialia, celeriter maturescentia, sine ostiolo, globosa vel subglobosa, 350–550 µm diam, mollia, mycelio flavo vel aurantiaco obtecta; paries ex hyphis dense intricatis compositus. Asci catenulati, 8-spori, ovoidei vel interdum subglobosi, 9–12.5 x 7.5–10 µm, evanescentes. Ascosporae primum hyalinae vel pallide flavae, mox cyanescentes, postremo indigoticae, ellipsoideae, 3.5–5 x 2.5–3 µm, spinosae.

Conidiophora ex hyphis aeriis; stipites breves, 10–15 (–40) x 2–3 µm, leves, septati. Penicilli biverticillati vel monoverticillati. Metulae 2–4 verticillatae, paulo divergentes, 8–12 x 2–2.5 µm. Phialides 3–6 verticillatae, acerosae, 10–12.5 x 2–3 µm. Conidia hyalina, ovoidea vel ellipsoidea, 2–3 x 1.5–2(–2.5) µm, levia, in catenis implicatis connexa.

Holotypus SUM 3010, colonia exsiccata ex solo in Godawari, Lalitpur, C. D. R., Nepalia, 2 Sept., 1986, S. Udagawa isolata et ea in collectione fungorum Musei et Instituti Historiae Naturalis, Chiba (CBM) conservata.

Etymology: from Latin, *indigoticus* = indigo-blue, referring to the color of the ascospores.

Colonies on Czapek agar growing restrictedly, attaining a diameter of 15 mm within 7 days at 25°C, floccose, plane, thin, loose-textured; ascomata slowly produced and intermixed with scattered conidia, light yellow to pastel yellow (M. 4A4–3A4, after Kornerup and Wanscher, 1978) or Ochreous to Amber (Rayner, 1970); reverse orange red to greenish red (M. 8B7–9B6) or Scarlet to Red, then Rosy Buff (Rayner).

Colonies on CYA growing rather rapidly, attaining a diameter of 16 mm within 7 days and developing up to 40 mm within 12 days at 25°C, floccose, plane, consisting of a thin basal felt with abundant ascomata, pale red to grayish yellow (M. 8A3–4B4) or Flesh to Salmon (Rayner); conidiogenesis more profuse but not sufficiently produced to influence the colony appearance; exudate clear, small; odor musty; reverse brownish red to violet brown (M. 9C6–10F13) or Coral, then Red to Blood Colour (Rayner).

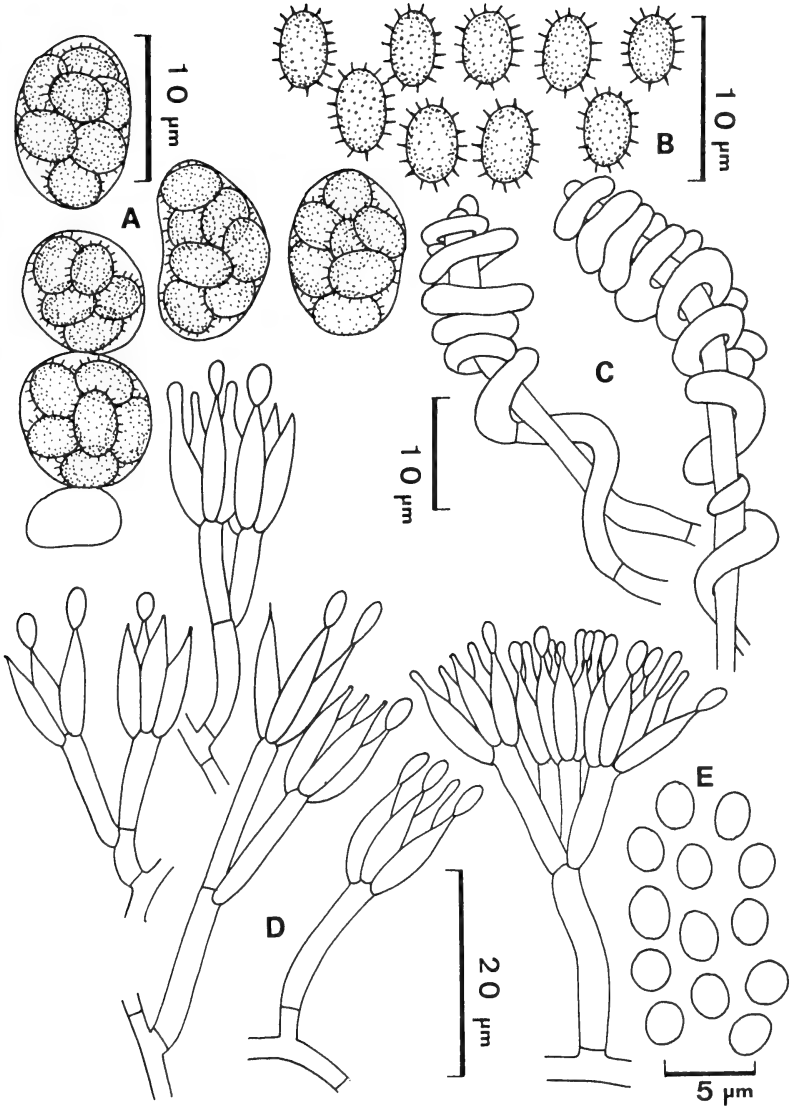


Fig. 1. *Talaromyces indigoticus*, SUM 3010. A. Asci. B. Ascospores. C. Ascomatal initials. D. Penicilli. E. Conidia.

Colonies on malt extract agar growing restrictedly, attaining a diameter of 20 mm within 7 days at 25°C, floccose, plane, very thin, showing the same cultural characteristics as on CYA, producing abundant ascomata in the central to subcentral areas, vivid yellow to yellowish orange (M. 3A8–4A7) or Luteous (Rayner); reverse light yellow (M. 4A4) or Pale Luteous (Rayner).

Colonies on oatmeal agar spreading broadly, attaining a diameter of 28 mm within 7 days and developing up to 48–52 mm within 12 days at 25°C, floccose, plane, consisting of a thin basal felt, in which numerous ascomata develop, showing light yellow to orange (M. 3A5–5A6), becoming Straw to Apricot (Rayner) in the central area; conidiogenesis sparse; exudate clear, small; odor musty; reverse light yellow (M. 4A4) or Straw to Ochreous (Rayner).

Ascomata superficial, discrete or confluent, ripening within 12 days, non-ostiolate, globose to subglobose, 350–550 µm in diam, soft, surrounded by a loose weft of straight or sinuous, yellow- to orange-pigmented mycelium; ascomatal wall consisting of densely interwoven, 1–2.5 µm wide hyphae; ascomatal initials conspicuous, appearing as two branches of the aerial hyphae, consisting of cylindroidal, somewhat sinuate hyphae around which similar thick hyphae are coiled tightly several times. Asci in chains, 8-spored, ovoidal or sometimes subglobose, 9–12.5 x 7.5–10 µm, evanescent. Ascospores at first hyaline to pale yellow, soon becoming blue in mounting fluid, finally indigo-blue, ellipsoidal, 3.5–5 x 2.5–3 µm, spinose.

Conidiophores arising primarily from aerial hyphae, stipes short, 10–15(–40) x 2–3 µm, smooth-walled, septate. Penicilli biverticillate or monoverticillate, rarely fragmentary. Metulae in small verticils of 2–4, rather divergent at angles, 8–12 x 2–2.5 µm. Phialides 3–6 per metula, lanceolate, 10–12.5 x 2–3 µm, with long collula. Conidia hyaline, ovoidal to ellipsoidal, 2–3 x 1.5–2(–2.5) µm, smooth-walled, borne in short disordered chains up to 100 µm long.

At 37°C, growth is slow, consisting only of white mycelium.

Specimens examined: soil, Royal Botanic Garden, Godawari, Lalitpur, C. D. R., Nepal, Sept. 2, 1986, SUM 3010 (holotype); soil, Minamikushiyama-mura, Minamitakagi-gun, Nagasaki-ken, Japan, Sept. 1, 1967, M 3133; soil, Ishigaki-shi, Okinawa-ken, Japan, June 11, 1973, M 5589.

Talaromyces indigoticus is placed in the series *Flavi* of the section *Talaromyces* (Stolk and Samson, 1972; Pitt,

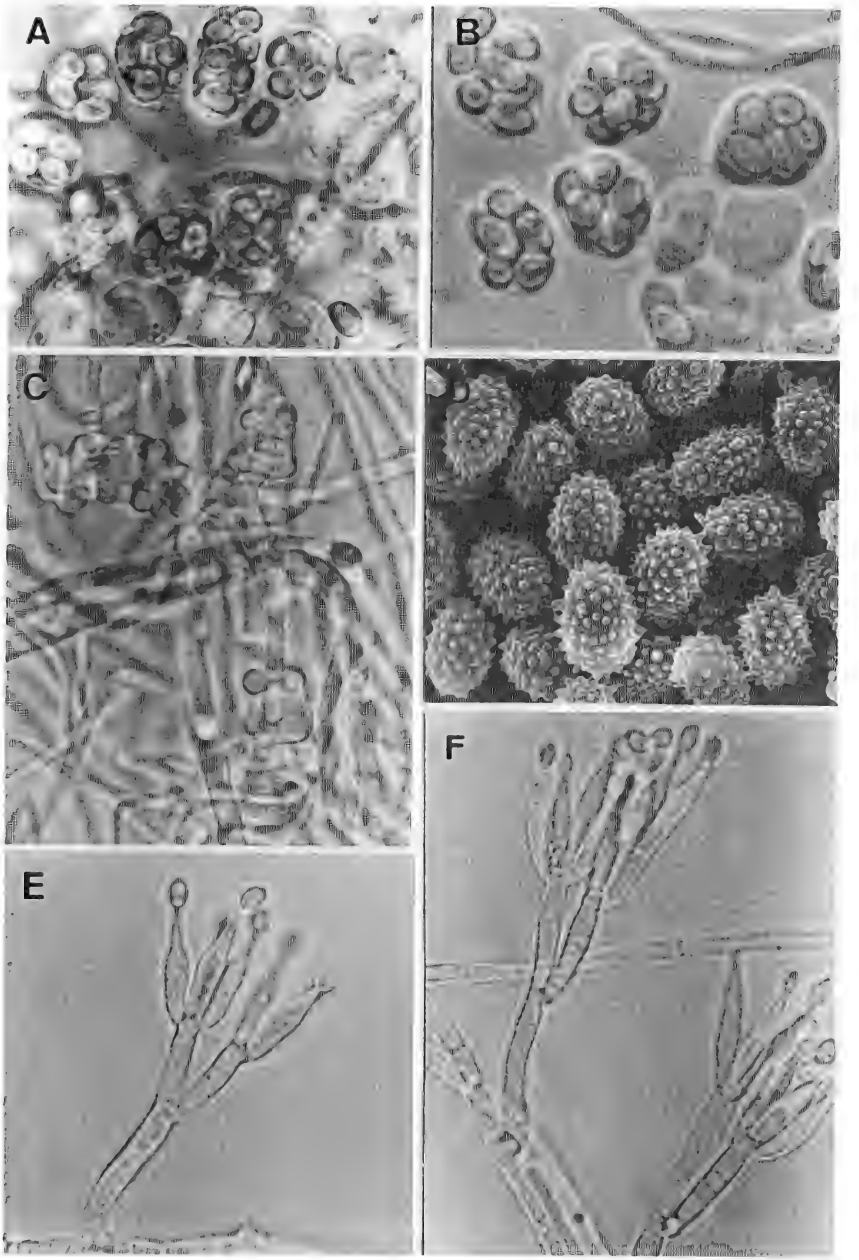


Fig. 2. *Talaromyces indigoticus*, SUM 3010.

1979) on the basis of its mesophilic growth, yellowish ascomata, ellipsoidal, spinose ascospores and well-developed biverticillate penicilli. The dimensions and ornamentation of its ascospores indicate that the new species has a close affinity with *T. flavus* (Kloecker) Stolk et Samson. It differs from the latter species in having bluish ascospores and short conidiophores with divergent penicilli. The ascomatal initials of *T. indigoticus* are also distinctive as developing into two equally thick gametangia.

ACKNOWLEDGMENT

Appreciation is expressed to Professor D. Malloch of the University of Toronto for reviewing the manuscript.

LITERATURE CITED

Kornerup, A. and Wanscher, J. H. 1978. "Methuen Handbook of Colour," 3rd ed., Eyre Methuen, London. 252p.

Pitt, J. I. 1979. "The Genus *Penicillium* and Its Teleomorphic states *Eupenicillium* and *Talaromyces*," Academic Press, London. 634p.

Rayner, R. W. 1970. "A Mycological Colour Chart," Commonwealth Mycological Institute, Kew and the British Mycological Society.

Stolk, A. C. and Samson, R. A. 1972. Studies on *Talaromyces* and related genera II. The genus *Talaromyces*. Stud. Mycol., Baarn 2: 1-56.

Explanation of Fig. 2.

Talaromyces indigoticus, SUM 3010.

A. Asci, x 1,350. B. Asci, x 1,600. C. Ascomatal initials, x 1,600. D. Ascospores, x 3,600. E, F. Penicilli, x 1,600.

MYCOTAXON

Volume XLVI, pp. 135-140 January-March 1993

LICHENES CANADENSES EXSICCATI: FASCICLE IV

Irwin M. Brodo and Pak Yau Wong

Canadian Museum of Nature, P.O. Box 3443, Station 'D', Ottawa, Ontario K1P 6P4 Canada

ABSTRACT

Twenty-five Canadian lichens are issued in this exsiccat series, numbers 226-250. Of these, 14 are from British Columbia, eight are from southern Ontario, and one each from Manitoba, Quebec and the Yukon. *Pannaria laceratula* Hue is reported as new to North America. Notes are presented on the following species: *Agrestia hispida, Cladonia macilenta, C. symphycarpa, C. verruculosa, Lecanora allophana, Pannaria laceratula, Peltigera pacifica, P. retifoveata, P. venosa* and *Porpidia carlottiana.*

The Lichenology Section of the National Herbarium of Canada (CANL) continues the publication of its series of Canadian lichen specimens, Lichenes Canadenses Exsiccati, with the distribution of Fascicle IV. This fascicle consists of 25 numbers (nos. 226-250) mainly representing material from British Columbia (14, including five from the Queen Charlotte Islands and almost all the remainder from Wells Gray Park in the interior), with other material from southern Ontario (8), Manitoba (1), Quebec (1) and the Yukon Territory (1). All but a few of the specimens were collected in the course of documenting the lichen floras of the Ottawa region (Brodo 1988), southern Ontario (Wong & Brodo 1990, 1992), the Queen Charlotte Islands, B.C. (Brodo, in prep.), Wells Gray Provincial Park, B.C. (Goward and Ahti, in press) and Churchill, Manitoba (Scott 1991). The previous three fascicles of this exsiccat (Brodo 1971, 1977, 1984) were issued in sets of 75.

As before, the exsiccat is being distributed in 36 complete sets. The recipients of this fascicle include ALTA, ANUC, Aptroot, ASU, BG, BM, CANL, C, COLO, DUKE, GZU, H, HMAS, IFP, Kalb, LD, LE, LSU, M, MB, MIN, NBM, NDA, NY, O, OMA, SASK, SRP, TNS, TRTC, TU, UBC, UPS, US, Vězda, and WIS.

Notes on chemistry of the specimens is based on studies using thin layer chromatography with the standardized methods of Culberson (1972) with her later modifications.

226. Agrestia hispida (Mereschk.) Hale & Culb.
BRITISH COLUMBIA, Fraser River Basin (Kamloops area), NW of Tranquille, along Forestry Trail, near east end of Dewdrop Ridge, 50°47′N, 120°34′W, Interior Douglas Fir Zone (hemiboreal), open, east- and south-facing ridge, rather exposed, elev. 1000 m, terricolous over loose, barren earth, *Goward 88-118*, 28 May 1988. Contains no substances.

Some recent studies (Hafellner 1991) have thrown some doubt on the generic distinctiveness of *Agrestia*. It is undoubtedly closely related to *Aspicilia* and should perhaps be considered as a morphotype within that genus. The collector, Trevor Goward, collected *A. hispida* at two other localities near Kamloops, and says (in litt.) that "it will probably prove to be not uncommon in the semi-arid southern interior of B. C."

227. Arthonia byssacea (Weigel) Almq.
ONTARIO, Ottawa-Carleton County, Gloucester, cedar swamp, on east side of Albion Road, just south of Leitrim Road intersection, 45°17′N, 75°35′W, white cedar-red maple woods, on white cedar, *Wong 4522*, 8 September 1989. Contains 2′-*O*-methylperlatolic acid.

Arthonia byssacea was reported as new to Canada in Wong & Brodo (1990) based on this collection. The exsiccat material is richly fruiting, but the species is often found sterile or only with pycnidia.

228. Bacidia polychroa (Th. Fr.) Körber (Syn. *Bacidia fuscorubella* (Ach.) Bausch)
ONTARIO, Renfrew County, Centennial Lake, SE end, along old overgrown road, 45°09′N, 77°02′W, mixed spruce-fir-willow thickets and forest, on *Populus grandidentata*, *Brodo 25211*, 28 August 1985. Contains only atranorin.

229. Cladonia cariosa (Ach.) Sprengel.
BRITISH COLUMBIA, Fraser River Basin, Wells Gray Provincial Park, south side near Blackwater Creek on McLeod Hill Road, 52°00′N, 120°00′W, in the open and recent burn, over volcanic soil on W-facing hillside with *Apocynum androsaemifolium*, elev. 600 m, *Goward 80-812*, 25 June 1980. Contains atranorin, fumarprotocetraric and fatty acids.

230. Cladonia macilenta Hoffm.
BRITISH COLUMBIA, Vancouver Island, Victoria, main gates of University of Victoria, at Henderson and Cedar Crossroads, 48°28′N, 123°25′W, lignicolous over *Thuja* and douglas fir fence rails, *Goward 82-154*, 30 April 1982. Contains thamnolic and barbatic acids.

Christensen (1987) has pointed out that, at least in western Europe, *C. macilenta* Hoffm. s. str. cannot be distinguished from *C. bacillaris* Nyl. on any basis other than chemistry, i.e., the former contains thamnolic acid. Both taxa contain barbatic acid. The North America populations have not yet been studied using the same criteria and are still being recognized at the species level (e.g., Egan 1987). The material in this exsiccat is *C. macilenta* in the strict sense.

231. Cladonia phyllophora Ehrh. ex Hoffm.
YUKON, 5 km NE of Whitehorse, on east side of Yukon River, 60°46′N, 135°02′W, in burned-over *Pinus contorta* stand, open, park-like, with *Ledum* ground cover, sandy soil, on ground under pines, *Brodo 26433*, 4 July 1988. Contains fumarprotocetraric and protocetraric acids.

232. Cladonia pleurota (Flörke) Schaerer.
ONTARIO, Ottawa-Carleton County, 15 km S of Richmond and 15 km W of Kemptville, 45°03′N, 75°52′W, in open maple-cedar glades, *Brodo 25258*, 26 September 1985. Contains usnic acid, zeorin, and possibly isousnic acid.

233. Cladonia squamosa (Scop.) Hoffm.
BRITISH COLUMBIA, Queen Charlotte Islands, Moresby Island, Mount Moresby, cirque lake on SW side of mountain, 53°01′N, 132°05′W, open subalpine meadow and talus slope, elev. 717 m, on exposed boulder on E-facing slope, *Brodo 26778*, 16 July 1988. Contains squamatic acid.

234. Cladonia symphycarpa (Ach.) Fr.
ONTARIO, Ottawa-Carleton County, 15 km S of Richmond and 15 km W of Kemptville, 45°03′N, 75°52′W, in open maple-cedar glades, *Brodo 25257*, 26 September 1985. Contains only atranorin.

The exsiccat material represents the strain containing atranorin alone (i.e., without norstictic acid). Although usually found only in the squamulose state, this material is richly podetiate. The similar *Cladonia dahliana* Krist., which contains psoromic acid as well as atranorin, is also common in the Ottawa Region.

235. Cladonia turgida Ehrh. ex Hoffm.
ONTARIO, Ottawa-Carleton County, Fitzroy Harbour, 5 km SE of harbour, 16 km NW of Carp, 45°27′N, 76°11′W, open field of granitic outcrops, on soil, *Wong 2829*, 25 June 1979. Contains atranorin and fumarprotocetraric acid.

236. Cladonia verruculosa (Vainio) Ahti.
BRITISH COLUMBIA, Queen Charlotte Islands, Graham Island, Tlell, mouth of the Tlell River close to East Beach, 53°36′N, 131°56′W, with *Picea sitchensis* on sandy and gravelly shoreline slope, *Brodo 26541*, 9 July 1988. Contains fumarprotocetraric and protocetraric acids.

This species, until recently known only from the west coast of North America was discussed by Ahti (1978). It is fairly common on the Queen Charlotte Islands. Its tall, slender, granulose or minutely squamulose to granular sorediate, mostly decorticate podetia make it a distinctive species, especially when producing small centrally proliferate cups. It always produces fumarprotocetraric and protocetraric acids. The species is now known from California (Hammer and Ahti 1990; Hammer 1991) as well as from South America (Ahti & Kashiwadani 1984; Hammer and Ahti 1990).

237. Gonohymenia nigritella (Lettau) Henssen (Syn. *Thyrea nigritella* Lettau)
QUEBEC, Gatineau County, Gatineau Park, King Mountain area off Mountain Road, ca. 5 km NW of Notch Road, S-facing limestone cliff, 45°29′N, 75°52′W, elev. ca. 130 m, *Brodo 19076*, 28 September 1972. Determined by Aino Henssen. Contains no substances.

The North American species of the genus *Gonohymenia* will be revised in a paper being prepared by Aino Henssen, in which the very similar *Thyrea confusa* Henssen (= *Th. pulvinata* sensu N. Amer. auct.) will be discussed.

238. Hydrothyria venosa J. Russell.
BRITISH COLUMBIA, Fraser River Basin (Kamloops District), 12 km NE of Clearwater Village, southern slopes of Trophy Mountains, 51°47′N, 119°53′W, open subalpine meadow, hemiarctic zone, elev. 200 m, growing over sandy bottom of spring-fed stream, *Goward 83-638*, 29 June 1983.

239. Julella fallaciosa (Stizenb. ex Arnold) R. Harris (Syn. *Polyblastiopsis fallaciosa* (Stizenb. ex Arnold) Zahlbr.
ONTARIO, Renfrew County, 5 km S of Schutt, junction of Hwy 28 and 514, 45°13′N, 77°27′W, mature deciduous forest, mainly maple, 15-20 m tall, on mature *Acer*, *Wong 4231*, 21 August 1986. Contains no substances.

An excellent description and discussion of this species is provided by Harris (1973) (sub *Polyblastiopsis fallaciosa*).

240. Lecanora allophana Nyl.

ONTARIO, Renfrew County, Centennial Lake, near bridge at mouth of Mackie Creek, along hydro access road, 45°09′N, 77°03′W, on *Populus tremuloides* along road in open, *Brodo 25221*, 29 August 1985. Contains atranorin, Lgr-1, and Lgr-2.

The apothecia on the exsiccat specimen are small and rather adnate, as opposed to large and constricted at the base, the characteristics usually associated with *L. allophana*. The spores, however, are large, typical of the species. In eastern North America, specimens with small, rather flat apothecia are common on *Populus tremuloides*.

241. Lecanora rugosella Zahlbr.

ONTARIO, Renfrew County, ca. 32 km SSW of Renfrew, 45°13′N, 76°53′W, "Stubinsky's Bog," low-lying wet woods and bog, with *Thuja occidentalis*, *Fraxinus* spp., *Picea mariana*, and *Larix*, *Brodo 25118*, 27 August 1983. Contains atranorin and roccellic acid.

242. Letharia columbiana (Nutt.) Thomson

BRITISH COLUMBIA, Coast area (Cascade Strip), 25 km SSW of Tatia Lake, northern flank of Razorback Mountain, 51°42′N, 124°45′W, very dry W-facing slope on Upper Boreal/Engelmann Spruce-Subalpine Fir Zone, elev. 1900 m, on branches of *Pinus albicaulis* in open, *Goward 81-1465*, 12 July 1981. Contains vulpinic acid.

243. Nephroma arcticum (L.) Torss.

BRITISH COLUMBIA, Fraser River Basin, Wells Gray Provincial Park, near Kostal Lake, 52°20′N, 120°00′W, along open forest edge among moss over young lava rock, elev. 1220 m, *Goward 80-318b*, 9 July 1980. Contains usnic acid, zeorin, phenarctin and nephroarctin.

244. Pannaria laceratula Hue

BRITISH COLUMBIA, Queen Charlotte Islands, Graham Island, Cone Head, SW corner of Rennell Sound, 53°23′N, 132°39′W, low, forested area and headland rocks on point, elev. 0-7 m, on *Picea sitchensis*, *Brodo 26926*, 21 July 1988. Determined by P.M. Jørgensen. Contains trace of atranorin.

This distinctive species with its clear greyish brown, epruinose, subfoliose lobes, is somewhat reminiscent of *P. leucostictoides* Ohlsson and even contains atranorin like that species. Our lichen, however, differs in completely lacking a prothallus (usually conspicuous and blue-black in *P. leucostictoides*), and in having longer, more distinctly foliose lobes and larger apothecia (1-3 mm in diameter, often immersed in the thallus, vs. 0.8-1.5 mm and entirely adnate in *leucostictoides*). *Pannaria laceratula* was described from Japan and is new for North America. It is common on the Queen Charlotte Islands on both bark and rocks, and is probably found elsewhere along the coast in moist forests. It was named as a form of *P. lepidota* by Tuckerman (f. *corallifera*) based on several collections from Vancouver Island (Jørgensen, in litt.)

245. Peltigera pacifica Vitik.

BRITISH COLUMBIA, Skeens River Basin, Terrace area, 15 km NNW of town near Camp Creek (just N of Glacier Creek), 54°41′N, 128°41′W, over mossy log in open old-growth *Tsuga heterophylla* forest in sheltered gully, elev. 200 m, *Goward 91-1165*, 26 August 1991. Contains tenuiorin, methylgyrophorate, zeorin, and possibly dolichorrhizin.

This species, only recently described by Vitikainen (1985) based on material from a locality very close to this one in coastal British Columbia, is a lobulate member of the *P. polydactyla* group, having pale, broad veins close to the lobe tips. *Peltigera elizabethae* Gyelnik in the east has a much darker lower surface with only scattered white patches close to the lobe margins.

246. Peltigera retifoveata Vitik.

BRITISH COLUMBIA, Fraser River Basin, near Nazko Road, 30 km W of Quesnel, Lower Boreal/Sub-Boreal Spruce Zone, 52°58′N, 122°47′W, over "feather-mosses" on somewhat shady terrace above creek with *Picea glauca* and *Picea mariana* stand, elev. 860 m. *Goward 81-1533*, 16 July 1981. Verified by O. Vitikainen. Contains tenuiorin, zeorin, methylgyrophorate, and possbly dolichorrhizin.

Peltigera retifoveata, described along with *P. pacifica* by Vitikainen (1985) is close to *P. canina* (L.) Willd. in having broad, tomentose lobes. It differs in its thick, heavily tomentose, pale, raised veins especially in the older parts of the lobes, and in its almost black apothecia. The tufts of short, very dark brown rhizinae are also distinctive.

247. Peltigera venosa (L.) Hoffm.

BRITISH COLUMBIA, Fraser River Basin (Kamloops District), Clearwater, 5 km S of town, along Little Fort Road, 51°35′N, 120°02′W, steep sandy and gravelly road bank, on soil, *Brodo 27261*, 5 August 1988. Contains tenuiorin, methylgyrophorate, and 3 unnamed triterpenes.

The cephalodia of *Peltigera venosa* occur mainly on the lower surface of the normal, green-algal lobes, but sometimes develop as squamules. Ott (1988) describes, discusses, and illustrates this phenomenon in lucid detail. All these stages of cephalodial development can be seen in the exsiccat material.

248. Porpidia carlottiana Gowan

BRITISH COLUMBIA, Queen Charlotte Islands, Chaatl Island, 53°08′N, 132°35′W, cove on NE corner of island facing ocean, elev. 0.1 m, on headland rocks, *Brodo 26974*, 22 July 1988. Contains glaucophaeic and 2'-0-methylsuperphyllinic acids.

This species is extremely close to *P. glaucophaea* (Koerber) Hertel & Knoph, differing mainly in lacking soredia (Gowan 1989). European populations of *P. glaucophaea* sometimes lack soredia as well, but are entirely sympatric with the sorediate morphs. The western North American population is probably genetically distinct based on its uniformly esorediate condition and generally larger size, and so was recognized as a separate species by Gowan (1989).

249. Rhizocarpon grande (Flörke ex Flotow) Arnold.

MANITOBA, Churchill, east shore of Bird Cove, 18 km E of town, 58°47′N, 93°51′W, Churchill quarzite outcrops along shore, *Brodo 27485*, 23 June 1989. Contains gyrophoric and a trace of lecanoric acids.

250. Siphula ceratites (Wahlenb.) Fr.

BRITISH COLUMBIA, Queen Charlotte Islands, Graham Island, Mercer Lake, 53°34′N, 132°52′W, ridge NE of lake, elev. 317 m, terraced fens, with *Pinus contorta* and *Tsuga mertensiana*, in fen pools and gravelly areas around pools, *Brodo 26966*, 21 July 1988. Contains siphulin.

ACKOWLEDGEMENTS

We are deeply indebted to Trevor Goward for so generously contributing to this series with excellent, well-identified material, both for this fascicle and previous ones. Aino Henssen and Orvo Vitikainen kindly verified our specimens of *Gonohymenia* and *Peltigera retifoveata*, respectively, and Per Magnus Jørgensen named our *Pannaria*, for which we are most grateful. We also thank Leif Tibell for reviewing this paper.

LITERATURE CITED

AHTI, T. 1978. Two new species of *Cladonia* from western North America. *Bryologist* **81**: 334-338.

AHTI, T. and H. KASHIWADANI 1984. The lichen genera *Cladia, Cladina* and *Cladonia* in Southern Chile, pp. 121-125 in H. Inoue, ed., *Studies on the cryptogams in southern Chile.* Kenseicha Ltd., Tokyo.

BRODO, I.M. 1971. Lichenes Canadenses Exsiccati: A new series of Canadian lichens. *Bryologist* **74**: 151-153.

BRODO, I.M. 1977. Lichenes Candenses Exsiccati: Fascicle II. *Bryologist* **79**: 385-405.

BRODO, I.M. 1984. Lichenes Canadenses Exsiccati: Fascicle III. *Bryologist* **87**: 97-111.

BRODO, I.M. 1988. *Lichens of the Ottawa region, second edition.* Ottawa Field-Naturalists' Club Spec. Publ. 3: 1-115, Ottawa.

CHRISTENSEN, S.N. 1987. Morphological and chemical variation in the *Cladonia macilenta/bacillaris* aggregate in Denmark. *Lichenologist* **19**: 61-69.

CULBERSON, C.F. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113-125.

EGAN, R.S. 1987. A fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. *Bryologist* **90**:77-173.

GOWAN, S.P. 1989. The lichen genus *Porpidia* (Porpidiaceae) in North America. *Bryologist* **92**: 25-59.

GOWARD, T. and T. AHTI 1992. Macrolichens and their zonal distribution in Wells Gray Provincial Park and its vicinity, B.C. (in press).

HAFELLNER, J. 1991. Die Gattung *Aspicilia*, ihre Ableitungen nebst Bemerkungen über cryptolecanorine Ascocarporganisation bei anderen Genera der Lecanorales Ascomycetes lichenisati). *Acta Botanica Malacitana* **16**: 133-140.

HAMMER, S. 1991. A preliminary synopsis of the species of *Cladonia* in California and adjacent Oregon. *Mycotaxon* **40**: 169-197.

HAMMER, S. and T. AHTI 1990. New and interesting species of *Cladonia* from California. *Mycotaxon* **37**: 335-348.

HARRIS, R.C. 1973. The corticolous pyrenolichens of the Great Lakes Region. *Michigan Botanist* **12**: 3-68.

OTT, S. 1988. Photosymbiodemes and their development in *Peltigera venosa. Lichenologist* **20**: 361-368.

SCOTT, P. 1991. *The flora of Churchill, Manitoba.* litho. (Distributed by author.)

VITIKAINEN, O. 1985. Three new species of *Peltigera* (lichenized fungi). *Annales Botanici Fennici* **22**: 291-298.

WONG, P.Y. and I.M. BRODO 1990. Significant records from the lichen flora of southern Ontario, Canada. *Bryologist* **93**: 357-367.

WONG, P.Y. and I.M. BRODO 1992. The lichens of southern Ontario, Canada. *Syllogeus* **69**: 1-79.

MYCOTAXON

Volume XLVI, pp. 141-154 January-March 1993

A SYNOPTIC KEY TO XYLARIA SPECIES FROM CONTINENTAL UNITED STATES AND CANADA BASED ON CULTURAL AND ANAMORPHIC FEATURES

Brenda E. Callan
Forestry Canada, Pacific Forestry Centre,
506 West Burnside Rd.,
Victoria, B. C. Canada V8Z 1M5

and

Jack D. Rogers
Department of Plant Pathology
Washington State University
Pullman, WA USA 99164-6430

ABSTRACT

A preliminary synoptic key based on cultural and anamorphic features is presented for twenty-three *Xylaria* species known to occur in continental United States and Canada. A list of substrates on which teleomorphs are usually encountered is given, along with references for more complete cultural descriptions.

KEY WORDS: *Xylaria, Xylocoremium, Nodulisporium, Geniculosporium,* anamorph, culture

Xylaria Hill ex Schrank species and their allies are frequently encountered in their asexual states by field collectors and by individuals culturing plant tissues for pathogens or endophytes. Common substrates include decorticated wood, soil, fruits, seeds, and diseased and healthy living plant tissues (11, 13, 17, 18). Identification of *Xylaria* anamorphs to date has often been difficult, as most keys are based on teleomorphic features alone. The synoptic key presented herein was constructed using colonial and anamorphic features as observed in cultures. It is intended to be used in the absence of teleomorphic data.

With few exceptions, *Xylaria* species produce conidia holoblastically on conidiogenous cells that proliferate in a sympodial manner. Conidiophores usually are laterally compressed into a tight layer or palisade covering all or part of the supporting stromatal surface. Conidia of most species are hyaline to subhyaline, ovoid to ellipsoid, with a flattened basal scar indicating the former point of attachment to the conidiogenous cell. Some *Xylaria* anamorphs have

conidiogenous regions resembling form-genus *Geniculosporium* Chesters & Greenhalgh, but the long conidiophores characteristic of the genus are usually lacking. Typical *Geniculosporium* anamorphs are produced by members of the *Hypoxylon serpens* complex (8, 12). Younger conidiogenous cells often appear similar to *Hadrotrichum* Fuckel as illustrated by Petrini and Petrini (11), with only a few apical conidial secession scars and little or no geniculation yet evident. Occasionally in *Xylaria longipes* Nitschke, secondary conidia are produced from old conidiogenous loci or the conidiogenous locus can proliferate percurrently (14).

In nature, *Xylaria* conidia may be produced on the surface of the immature perithecial stroma, on anamorphic appendages borne on developing perithecial stromata, or on separate structures distinct from teleomorphic stromata. In the latter case, anamorphic and teleomorphic structures are strikingly different in appearance, and separated physically and temporally. *Xylaria cubensis* (Mont.) Fr. with its separate and distinct *Xylocoremium* J. D. Rogers state is an example (16). Rogers (17) discussed the position and location of the anamorph in the natural life cycles of *Xylaria* species. Unfortunately, these aspects of the life cycles are not always revealed in cultures, as seen later herein.

The most favorable medium for stromatal and conidial production by most *Xylaria* species is 2% oatmeal agar (Difco) (OA) and it is our eventual goal to characterize every species on that medium. All cultures characterized herein were grown on OA. Many *Xylaria* species were described from other media before we recognized the overall utility of OA. *Xylaria* cultures can differ considerably in appearance on various media. Some of the references describe colonies on the following media: 2% potato dextrose agar (Difco) with 5 g/l yeast extract (Difco) (PDYA); a variation of malt extract agar (MEA) formulated without peptone (Difco malt extract, 20 g; Difco agar, 17.7 g; distilled water, 1.1 liter) (9); and Leonian's agar (LA) (KH_2PO_4, 1.2 g; $MgSO_4.7\ H_2O$, 0.6 g; peptone, 0.6 g; glucose 6 g malt extract, 6 g; agar, 20 g; distilled water, 1 liter) (2).

Cultures were initiated from ascospores from mature teleomorphic stromata (see 4, 5 for methods). Conidiogenous structures are most easily examined when a coverslip coated with a thin layer of mucilage (Le Page's) is touched to a stromatal surface, stripping away individual conidiogenous cells from the supporting stroma (4, 5). The coverslip bearing fungal structures is then inverted in a drop of water or another mounting medium on a slide and examined.

Construction and Use of the Key

Taxa included in the key are among those known to occur in continental USA and Canada. Teleomorphs are included in a key by Rogers (18). Where possible, cultures that provided the information used to develop the key were initiated from teleomorphs collected in continental USA and Canada. In several cases the only available cultures were from material collected elsewhere and these are included here. Some taxa have been cultured only a few times. Thus, the complete range of cultural phenomena to be expected for certain species is

unknown.

The key can be entered at any point and taxa (by number) eliminated until one or a small number remain. It will usually be most convenient to enter the key at categories dealing with culture growth rate, color, and general morphology. Two plates depicting some of the colonial and stromatal features used in the key are provided.

The list of cultural features associated with specific taxa should be consulted as a potential shortcut, as should the list of host associations when certain hosts are involved. When all but one or a few taxa remain the cited literature should be consulted for detailed cultural descriptions. In some cases it might be necessary to make subcultures on one of the media described earlier herein in order to make meaningful comparisons with published descriptions.

Discussion of Characters Used in Key

Growth rate: This refers to the number of weeks for a colony radiating from a central inoculation to cover a 9 cm diameter plastic Petri plate incubated at ca. 20 C and ca. 12 h of fluorescent light per day under laboratory conditions. Fast-growing cultures cover the plate in about 2 weeks. Some cultures never cover the plate prior to desiccation or staling.

Colony colors: The colors of a colony usually change as it ages. Thus, developing and mature colony colors are both described.

Exudates: Colored exudates as droplets on the colony surface seem diagnostic for a few species. For most species it seems unimportant.

Color of reverse: OA is a dense medium that seems generally to remain uncolored by exudates. Thus, reverse coloration of the agar is uncommon. In a few cases, however, it is noteworthy and should be recorded.

Colony surface morphology: Colonies of *Xylaria* species often show changes in the colony surface from the inoculation points to the margins, e.g. a colony that is appressed at the margin might be lanose or floccose toward the inoculation point. As colonies cease to expand radially the surface tends to become more uniform.

Colony margins: The margins of most colonies are entire to somewhat scalloped. A few, however, are conspicuously plumose. The morphology of margins should be recorded.

Stromatal production: Colonies of most species eventually produce stromata. Some produce few stromata, others dense stands of stromata. Although "few stromata" vs "many stromata" seems highly subjective it is a workable concept when cultures of a number of taxa have been examined. Generally, "few stromata" would be 1-5, whereas "many stromata" would be from 6 to 100 or

more.

Stromatal morphology: Taxa generally produce either large robust stromata or wire- to hair-like stromata. A few taxa produce flabelliform stromata or rudimentary cushion-shaped structures.

Other features of colony surface: Colonies of some taxa have diagnostic features such as highly coiled or bristle-like hyphae, or sclerotia. In some taxa the stromata are notably villose or tomentose at the bases. Indeed, some stromata become hairy almost to the growing apex. We call such stromata "moles" for their fanciful resemblance to a blind, burrowing animal.

Presence of anamorph: Colonies of some species are not known to produce the anamorph. Colonies of other species seem always to produce the anamorph. At least one species--*X. cubensis*--produces distinct separate anamorphic and teleomorphic stromata in nature (16). Cultures of *X. cubensis* usually produce the flabelliform anamorphic stromata, but sometimes produce only sterile conic stromata. The latter are thought to represent the immature aconidial teleomorph. The type of anamorphic structures produced in nature are not always produced in culture. For example, *X. tentaculata* Berk. & Broome produces conidia on special radiating stromatal appendages in nature, but such structures are not produced in culture (4, 5). Some taxa produce copious readily germinating conidia. These initiate satellite colonies around the main colony.

Location of conidiogenous areas: Most *Xylaria* species produce conidia on stromata. In some species production occurs over the entire club, in others only at the apex. A few species produce conidia on areas of the colony surface, a feature more characteristic of *Hypoxylon* than of *Xylaria*.

Anamorph color in mass: Anamorphic colors tend to be either light (white or pink) or dark (yellow through gray). This seems consistent for a given species.

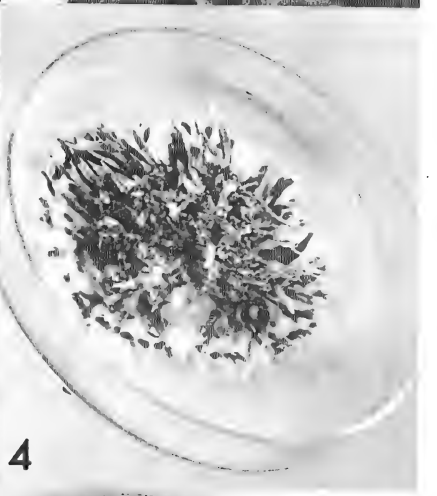
Conidial morphology: Conidia of xylariaceous fungi are morphologically similar. They are always unicellular with a flattened secession scar at one end. A few have features that are noteworthy, i.e. the apical corona on the conidium of *X. poitei* (Lév.) Fr. (20) and the long fusoid conidium of *X. cornu-damae* (Schwein.) Fr. (15). In general, conidia fall into certain diameter and length ranges that, along with other colony features, can be useful in identifying taxa in culture.

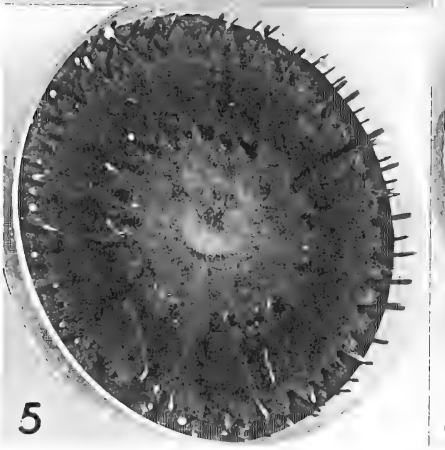
Figs. 1-6. *Xylaria* species in culture. 1 and 2. *X. comiformis*. 1. Culture with stromata, X 0.66. 2. Closeup of stroma composed mostly of villose base (called "mole type" by the authors), X 4. 3. *X. oxyacanthae*. Zonate colony with abundant rudimentary stromata in left hand part and a large stroma near center, X 0.66. 4. *X. carpophila*. Colony with stromata, X 0.66. 5. *X. apiculata*. Colony with stromata, X 0.66. 6. *X. coccophora*. Colony with stromata, X 0.66.

1

2

3


4


5

6

Conidiophore morphology: Conidiophores of many *Xylaria* species are packed into tight palisades. This close packing seems to diminish highly diagnostic features such as branching patterns in comparison to, for example, *Hypoxylon* anamorphs. In some cases, however, conspicuous geniculations or conidial secession scars can be diagnostic. Highly developed scars are most common and should be sought in aging conidiogenous areas. Young conidiogenous areas (those that have just begun to produce conidia) show few remarkable secession scars.

Xylaria species, key numbers, and references

1 - acuta Peck (15)
2 - allantoidea (Berk.) Fr. (5)
3 - apiculata Cooke (4) (Fig. 5)
4 - arbuscula Sacc. (4,5)
5 - carpophila (Pers.:Fr.) Grev. (6) (Fig. 4)
6 - coccophora Mont. (4,21) (Fig. 6)
7 - *corniformis (Fr.) Fr. (5,14) (Figs. 1 and 2)
8 - cornu-damae (Schwein.) Fr. (15)
9 - cubensis (Mont.) Fr. (16) (Figs. 9 and 10)
10 - hypoxylon (L.:Fr.) Grev. (3,6)
10A - hypoxylon west coast form (3)
11 - longiana Rehm (as "small-spored collection") (3,6) (Figs. 7 and 8)
12 - longipes Nitschke (3,14)
13 - magnoliae Rogers (6)
14 - multiplex (Kunze) Fr. sensu Dennis (3)
15 - oxyacanthae Tul. (22) (Fig. 3)
16 - persicaria (Schwein.:Fr.) Berk. & M. A. Curtis (6)
17 - poitei (Lév.) Fr. (20) (Fig. 12)
18 - polymorpha (Pers.:Fr.) Grev. (19) (Fig. 11)
19 - schweinitzii Berk. & M. A. Curtis (19)
20 - tentaculata Berk. & Broome (5)
21 - microceras (Mont.) Fr. (5)
22 - psamathos Boise (1)

*This fungus has been considered to be *X. curta* Fr. It is best considered to be *X. corniformis* (Fr.) Fr. Dennis (7) discovered type material of *X. corniformis* and Laessøe (10) further clarified the problem. Callan & Rogers (5) showed that cultures from stromata collected in New York and from French Guiana, respectively, are somewhat different. These differences reflect differences in the teleomorphs. Moreover, additional cultures from stromata collected from USA and from France, respectively, seem essentially identical.

Synoptic Key**

Growth rate (time to cover 9 cm Petri plate at 20C and 12 h fluorescent light):

2 weeks: 3, 4, 7, 9, 10, 10A, 14, 20

3-4 weeks: 6, 10A, 11, 12, 13, 18, 19, 21

Longer than 4 weeks: 15, 16, 17

Plate never entirely covered: 1, 2, 5, 8, 22

Developing colony color(s) (prior to covering plate):

White: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 10A, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

Pink: 7, 9, 10, 11, 22

Tan: 2, 7, 12, 17

Yellow: 2

Olive: 2

Brown: 4, 21

Gray: 1, 3, 5, 8, 10A, 13, 15, 16, 18, 19

Black: 1, 4, 7±, 8, 13, 14, 15, 16, 17, 18, 19, 20

Concentrically zonate (combination of 2 or more of the above colors): 4±, 6±, 13, 15, 18

Mature colony colors (after plate is covered or colony has ceased growth):

White: 1, 3, 5, 6, 7, 8, 9, 10, 10A, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

Pink: 7, 9, 10, 11, 22

Tan: 7, 12, 17

Yellow: 6, 21

Olive: 2

Brown: 3, 21

Gray: 1, 2, 3, 4, 5, 8, 10A, 13, 15, 16, 18, 19

Black: 1, 3, 4, 5, 6±, 7±, 8, 9±, 10, 11±, 13, 14, 15, 16, 17, 18, 19, 20

Concentrically zonate (combination of 2 or more of the above colors): 2, 6±, 13, 15, 18, 21

Exudate droplets on surface of colonies, especially young colonies:

Droplets clear: 1, 4, 5, 8, 10, 10A, 11, 13, 14, 15, 16, 18

Amber droplets: 21

Orange droplets: 19

Color of reverse, especially mature colonies:

Orange: 6, 10±, 11±, 14±

Brown: 3

Blackish: 18, 19

Surface morphology of colony:

Appressed: 1, 2, 3, 5, 7, 8, 9, 10, 10A, 11, 12, 14, 15, 16, 17, 18, 19, 22

Velvety: 4, 5, 6, 7, 11, 13, 14, 16, 20

Lanose: 5, 9, 13

Floccose: 4, 7, 9, 13, 14, 18, 20, 21, 22

Colony margins:

Entire: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22

Plumose: 1, 6, 8, 10A, 14, 19

Stromatal production:

Stromata never produced: 22

Few stromata produced: 3, 4, 9, 10A, 15, 18, 20

Many stromata produced: 1, 2, 5, 6, 7, 8, 9, 10, 10A, 11, 12, 13, 14, 16, 17, 18, 19, 21

Stromatal morphology:

Cylindrical to long conic, > 3 mm diam at base, often collapsing when mature: 12, 15±, 17, 18, 19, 20

Cylindrical to long conic, > 3 mm diam at base, not collapsing when mature: 4, 7, 9, 10A, 11, 13, 14, 16

Cylindrical to long conic, < 2 mm diam at base, wiry, seldom collapsing when mature: 2, 4, 5, 6, 10, 11, 15, 21

Very thin, sometimes almost hair-like, often in dense stands: 1, 8

Pulvinate: 3, 12, 15

Flabelliform: 6, 9

Other features on colony surface or within mycelial mat or associated with stromata:

Coiled hyphae on colony: 18

Discrete sclerotia: 20

Dark hair- or bristle-like hyphae associated with mat: 18

Stromata or at least bases notably tomentose or villose: 5, 7, 10A, 13, 16

Abundant satellite colonies from conidial germination: 8

Agar often becoming radially furrowed: 15

Presence of anamorph:

Not observed in culture: 3, 10A, 13, 16, 20, 22

Infrequent: 1, 15

Frequent: 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18, 19, 21

Location of conidiogenous areas:

On colony surface: 4, 12

Over surface of entire stroma: 4, 6, 7, 9, 12, 14, 15, 17, 18, 19

On apex of stroma: 1, 2, 5, 8, 10, 11, 21

Anamorph color in mass:

Conidial palisade white to pink: 1, 4, 5, 6, 8, 9, 10, 11, 14, 15, 21

Conidial palisade yellow, tan, olive, or gray: 2, 7, 12, 17, 18, 19, 21

Conidial morphology:

Conidia lacking noteworthy ornamentation: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 18, 19, 21

Conidia with apical corona: 2±, 17

Conidia more or less ellipsoidal to obovate: 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 17, 18, 19, 21

Conidia long ellipsoidal to fusoid: 8

Conidia with acute apex: 4±, 6±, 10±, 12±, 14±

Conidial diam mostly 1.5-3 µm: 4, 5, 9, 10, 11, 14, 15, 21

Conidial diam mostly 3-5 µm: 1, 2, 6, 7, 8, 12, 17, 18, 19

Conidial length mostly ≤5 µm: 4, 10, 14, 15

Conidial length mostly 5-7 µm: 5, 7, 9, 11, 14, 21

Conidial length mostly 7-10 µm: 1, 2, 6, 12, 17, 18, 19

Conidial length mostly 8-12 µm: 2, 8, 12

Conidiophore morphology:

Conidiophores mostly short, in tight palisade: 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 17, 18, 21

Conidiophores mostly long, branched, loose: 19

Conidiophores conspicuously geniculate: 9, 18

Mature conidiogenous areas with prominent conidial secession scars: 2, 4, 6, 7, 9, 17, 18, 19

** Check all choices in a given category before eliminating a possibility. Some taxa have features that are listed more than once. For example, under "Developing colony colors," taxon number 2 is listed with four color choices.

Short list of cultural features associated with specific taxa

Yellow colors in culture--*X. allantoidea, X. coccophora*

Abundant satellite colonies--*X. cornu-damae*

Pink flabelliform stromata producing great masses of pinkish conidia--*X. cubensis*

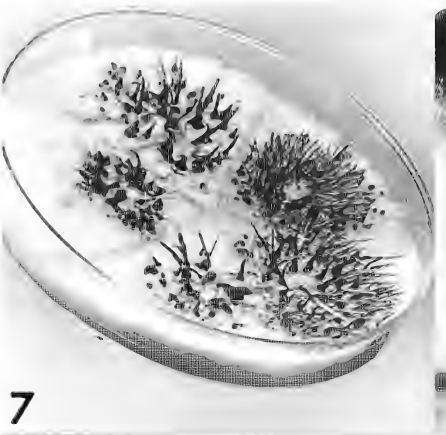
Colonies that are strikingly black or zonate black and white--*X. magnoliae*

Conidia that consistently bear an apical corona--*X. poitei*

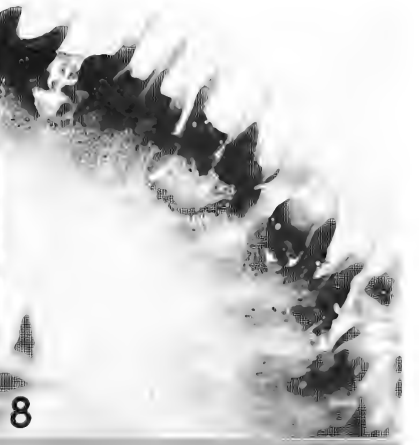
Colonies that have orange exudation drops--*X. schweinitzii*

Colonies that produce sclerotia--*X. tentaculata*

Figs. 7-12. *Xylaria* species in culture. 7 and 8. *X. longiana*. 7. Colony with stromata, X 0.66. 8. Closeup of stromata, X 1.7. 9 and 10. *X. cubensis*. 9. Colony bearing large flabelliform stromata bearing conidia and many smaller stromata, most of which remain sterile, X 0.66. 10. Large flabelliform stroma bearing powdery conidial bloom (fc) and smaller sterile stromata (?t) that might represent the incipient teleomorph, X 4. 11. *X. polymorpha*. Colony with large collapsing stromata, X 1.4. 12. *X. poitei*. Colony with large collapsing stromata, X 1.4.

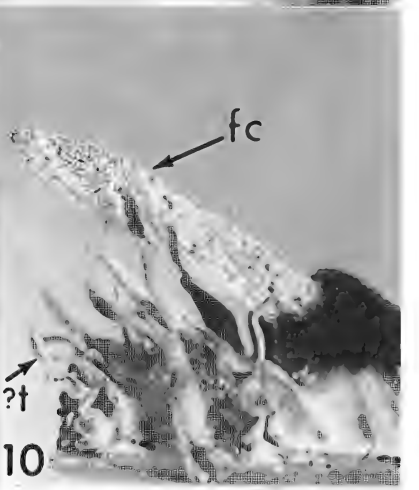


7

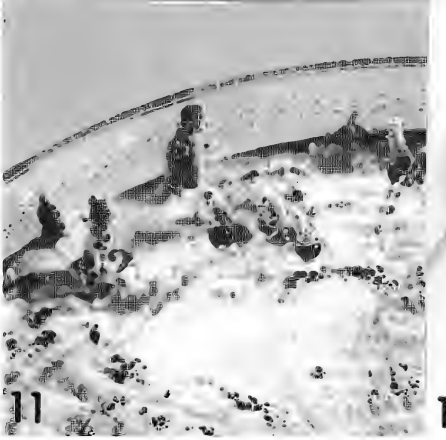


8

9



10



11

12

Host associations of *Xylaria* species based upon collections of the teleomorph

The host specificity of most *Xylaria* species is unknown. Many of them fruit on decayed wood and too often accurate substrate identifications are not made. It is likely that most *Xylaria* species are at least somewhat host specific. Evidence in the literature for a fungus-host association is the collection of a mature teleomorph from a known host. However, many *Xylaria* species are also isolated as endophytes from unexpected substrates, apparently never producing the teleomorph on them (11). Thus, the following list represents substrates that are highly likely to yield certain fungi, but is not meant to imply that these fungi might not be found elsewhere as endophytes, etc.

X. carpophila - Fruits of *Fagus* L.

X. comiformis - Wood of *Fagus* and other angiosperms.

X. longipes - Wood of *Acer* L. and occasionally other angiosperms.

X. longiana - Wood of *Quercus* L. and other angiosperms.

X. magnoliae - Fruits of *Magnolia* L.

X. mali Fromme - Wood of *Malus* Mill. This species not included herein because we have not seen it in culture. Consult ref. 15.

X. oxyacanthae - Seeds of *Crataegus* L.

X. persicaria - Fruits of *Liquidambar styraciflua* L.

ACKNOWLEDGEMENTS

PPNS No. 0134, Department of Plant Pathology, Project 1767, Washington State University, College of Agriculture and Home Economics. This project was supported by National Science Foundation Grant BSR-9017920 to JDR. We thank the following associates at Washington State University: Michael J. Adams for aid with photography; Lori M. Carris for reviewing the manuscript; and Jane Lawford for processing the manuscript. We thank Elwin Stewart, University of Minnesota, for reviewing the manuscript.

LITERATURE CITED

1. Boise, J. 1982. A new graminicolous species of *Xylaria*. Mycologia 74:467-471.

2. Booth, C. 1971. Fungal culture media. In: C. Booth, ed. Methods in microbiology. Vol. 4. Academic Press, London. p. 49-94.

3. Callan, B. E. 1985. Studies of the anamorphs of selected species of *Xylaria, Biscogniauxia* and *Rosellinia*. M.S. thesis, Washington State University. 111 pp.

4. Callan, B. E. 1988. Cultural and anamorphic features of tropical Xylarias and related Xylariaceae. Ph.D. dissertation, Washington State University. 127 pp.

5. Callan, B. E. and J. D. Rogers. 1990. Teleomorph-anamorph connections and correlations in some *Xylaria* species. Mycotaxon 36:343-369.

6. Chacko, R. D. and J. D. Rogers. 1981. Cultural characteristics of some species of *Xylaria*. Mycologia 73:415-428.

7. Dennis, R. W. G. 1984. Some Ascomycetes from the Maghrib, North Africa. Kew Bull. 39:759-770.

8. Jong, S. C. and J. D. Rogers. 1972. Illustrations and descriptions of conidial states of some *Hypoxylon* species. Wash. State Agric. Exp. Sta. Tech. Bull. No. 71. 51 p.

9. Kenerley, C. M. and J. D. Rogers. 1976. On *Hypoxylon serpens* in culture. Mycologia 68:688-691.

10. Laessøe, T. 1987. *Xylaria cornifomis* reconsidered. Mycotaxon 30:81-85.

11. Petrini, L. E. and O. Petrini. 1985. Xylariaceous fungi as endophytes. Sydowia 38:216-234.

12. Petrini, L. E. and J. D. Rogers. 1986. A summary of the *Hypoxylon serpens* complex. Mycotaxon 26:401-436.

13. Rogers, J. D. 1979. *Xylaria magnoliae* sp. nov. and comments on several other fruit-inhabiting species. Can. J. Bot. 57:941-945.

14. Rogers, J. D. 1983. *Xylaria bulbosa, Xylaria curta* and *Xylaria longipes* in continental United States. Mycologia 75:457-467.

15. Rogers, J. D. 1984a. *Xylaria acuta, Xylaria cornu-damae* and *Xylaria mali* in continental United States. Mycologia 76:23-33.

16. Rogers, J. D. 1984b. *Xylaria cubensis* and its anamorph *Xylocoremium flabelliforme, Xylaria allantoidea* and *Xylaria poitei* in continental United States. Mycologia 76:912-923.

17. Rogers, J. D. 1985. Anamorphs of *Xylaria*: taxonomic considerations. Sydowia 38:255-262.

18. Rogers, J. D. 1986. Provisional keys to *Xylaria* species in continental United States. Mycotaxon 26:85-97.

19. Rogers, J. D. and B. E. Callan. 1986a. *Xylaria polymorpha* and its allies in continental United States. Mycologia 78:391-400.

20. Rogers, J. D. and B. E. Callan. 1986a. *Xylaria poitei*: Stromata, cultural description, and structure of conidia and ascospores. Mycotaxon 26:287-296.

21. Rogers, J. D., B. E. Callan, A. Y. Rossman, and G. J. Samuels. 1988. *Xylaria* (Sphaeriales, Xylariaceae) from Cerro de la Neblina, Venezuela. Mycotaxon 31:103-153.

22. Stowell, E. A. and J. D. Rogers. 1983. Studies on *Xylaria oxyacanthae*. Mycotaxon 17:433-444.

MYCOTAXON

Volume XLVI, pp. 155-160 January-March 1993

A NEW BLUING *PSILOCYBE* FROM THAILAND

by

Gastón Guzmán ***Victor M. Bandala***
INSTITUTO DE ECOLOGÍA
APARTADO POSTAL 63
XALAPA, VERACRUZ 91000
MEXICO

and

John W. Allen
P.O. BOX 12053
HONOLULU 96828 1053
HAWAII

SUMMARY

Psilocybe samuiensis Guzmán, Bandala & Allen is described as a new species from Koh Samui, Thailand. It belongs to the hallucinogenic fungi of the Section ***Mexicanae*** Guzmán. This is the first record of a bluing ***Psilocybe*** from Thailand and the first species of the Section outside of the Americas. The form and size of the spores, the presence of pleurocystidia and the habit, similar to ***P. semilanceata*** (Fr. : Secr.) Kumm. or to ***P. cordispora*** Heim, are the most important features that define this species.

INTRODUCTION

Ethnomycological investigations in Southeast Asia, revealed the presence of psychoactive fungi used as recreation by young Europeans and North Americans visiting the area. Schultes & Hofmann (1973) reported the sale of these fungi by natives of Bali Island. Cox (1981) reported similar sales in Samoa and recently Allen (1991) and Allen & Merlin (1992) confirmed such practices in Thailand.

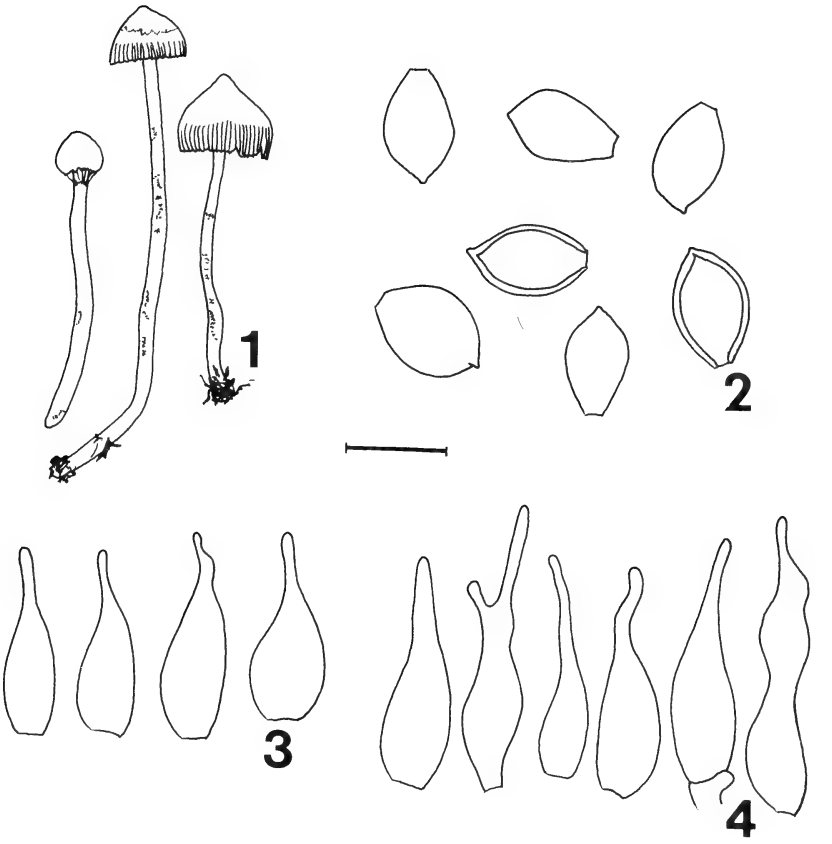
Amongst the fungi ingested as recreation in SE Asia, are ***Psilocybe cubensis*** (Earle) Sing. and ***P. subcubensis*** Guzmán, and in a complex species mixture ***Copelandia*** and ***Panaeolus***. One of the authors (Allen) of this paper, found in Koh Samui, Thailand, an interesting undescribed bluing species of ***Psilocybe*** only known by the native children who collect psychoactive fungi for sale. Examination of this material resulted in a new species described here .

Psilocybe samuiensis Guzmán, Bandala & Allen, sp. nov.

Figs. 1-4

Pileus 7-15 mm latus, subconvexus ad conico-convexus, conico-umbonatus, frequenter papillato, viscidus, laevis, marginem striatus, hygrophanus, badius vel rufobrunneus dein stramineus vel argillaceus. Lamellae adnatae dein adnexus, argillaceae, demum purpureo-brunnae vel violaceo-griseae. Stipes 40-65 x 1.5-2 mm, albidus vel ochraceus, fibrillosus, tactu caerulescentes. Vellum quasi cortina, fibrillosum. Sporae 10.4-12.8 x 6.4-8 μm, rhomboideae vel subrhomboideae, leviter ovoidae. Pleurocystidia 16-20 x 4.8-6.4 μm, hyalina, ventricosus sublageniformia. Cheilocystidia 18.4-28 (-30) x (4.8-) 5.6-7.2(-8) μm, ventricosus fusiforme vel submoniliforme, hyalina. Hyphae cuticulae pilei filamentosae subgelatinosae. Fibulae adsum. Specimen typicum in Herbarium Instituto de Ecologia (XAL) conservatun est. Legit prope Thailand, Koh Samui, 8 mensis Augustus 1991, Allen F (Isotypus in BISH et O).

Pileus 7-15 mm in diameter, subconvex to conic-convex, conic-umbonate or campanulate-umbonate, frequently with a small papilla, viscid, with a separable pellicle, glabrous, even but striate to sulcate at the margin, hygrophanous, chestnut or reddish-brown to straw-color, becoming pale straw-color or brownish clay when dry. Lamellae adnate to adnexed, clay-color, becoming violaceous brown or chocolate brown-violet when dry, with white edges. Stipe 40-65 x 1.5-2 mm, equal or slightly subbulbous, hollow, white or whitish to pale straw color, covered by subfloccose white fibrils, bluing. Veil cortinate, white, leaving whitish, fugaceous fibrils on the upper part of the stipe. Context concolorous with pileus, bluing, with slightly farinaceous taste and odor.



Figs. 1-4.- ***Psilocybe samuiensis***, 1: basidiomes, 2: basidiospores, 3: pleurocystidia, 4: cheilocystidia (all from the type) (scale bare = 10 μm in figs. 2-4, and 15 cm in fig. 1).

Spores 10.4-12.8 x 6.4-8 µm, rhombold or subrhomboid in face-view, broadly elllipsoid or subellipsoid in side-view, with yellowish brown, thick (0.4-0.8 µm) wall, and with broad flattened germ pore. Basidia 20-28 x 7.2-8.8 µm, 4-spored, hyaline, subcylindric-clavate. Pleurocystidia 16-20 x 4.8-6.4 µm, scattered, hyaline, ventricose sublageniform. Cheilocystidia 18.4-28 (-30) x (4.8-) 5.6-7.2 (-8) µm, abundant, hyaline, ventricose-lageniform or sometimes submoniliform, frequently with an irregular branched neck. Subhymenium with narrow hyphae to globose or subglobose cells, 2.4-8 µm diameter, hyaline but with incrusted yellow pigment on the walls. Hymenial trama regular, with cylindric hyphae, 2.4-16 µm wide, hyaline to yellowish. Epicutis formed of a gelatinized layer, with more or less parallel, hyaline hyphae, 0.8-4 µm diameter. Hypodermium with cylindric hyphae, 4-12 µm diameter, hyaline, but with yellowish incrusting pigment. Clamp connections common.

Habitat. Scattered to gregarious, in manured sandy-clay soils, in rice paddies, in meadows. July-October. Known only from the type locality.

Studied material. THAILAND, 2 km west of Ban Hua Thanon, Koh Samui, August 8, 1991, *Allen F* (Holotype XAL; Isotypes in BISH and O).

Discussion. Judging by the information supplied by native collectors and by the bluing feature, it is very probable that this fungus is psychoactive. This is an unusual species with habit somewhat similar to ***P. semilanceata*** (Fr. : Secr.) Kumm. in fresh conditions,or ***P. cordispora*** Heim in dry conditions,and microscopically similar to ***P. mexicana*** Heim. In fact the big rhomboid or subrhomboid spores place this species in Section ***Mexicanae*** Guzmán, but the size of the spores, presence of pleurocystidia and habit, easily separate it from the 6 known species of that Section [***P. mexicana***, ***P. acutipilea*** (Speg.) Guzmán, ***P. armandii*** Guzmán & Pollock, ***P. farinacea*** Rick ex Guzmán, ***P. galindii*** Guzmán and ***P. tampanensis*** Guzmán & Pollock]. This is the first record of Section Mexicanae outside of the Americas.

This is the fifteenth hallucinogenic species of ***Psilocybe*** known from S and SE Asia and Australia and neighboring islands. These species are: ***P. goniospora*** (B. & Br.) Sing., ***P. lonchoporus***

(B. & Br.) Horak ex Guzmán and ***P. ochreata*** (B. & Br.) Horak ex Guzmán from Sri Lanka, ***P. subaeruginascens*** Höhnel var. ***subaeruginascens*** from Java, ***P. brunneocystidiata*** Guzmán & Horak, ***P. inconspicua*** Guzmán & Horak, ***P. kumaenorum*** Heim and ***P. papuana*** Guzmán & Horak from New Guinea, ***P. australiana*** Guzmán & Watling, ***P. eucalypta*** Guzmán & Watling, ***P. semilanceata***, ***P. subaeruginosa*** Clel. and ***P. tasmaniana*** Guzmán & Watling from Australia and/or Tasmania, and ***P. aucklandii*** Guzmán, King & Bandala from New Zealand (Guzmán, 1983; Guzmán *et al.*, 1991).

Recently, Chang and Mills (1992) studied the isozymes and mating compatibility of some specimens of ***Psilocybe*** from Tasmania and compared with the types of ***P. australiana***, ***P. eucalypta***, ***P. subaeruginosa***, and ***P. tasmaniana*** and they explain: "In our experience, identification in the field is quite impossible". According to their study they concluded that the four names belong to one species, ***P. subaeruginosa***, and the color and morphological microscopic features used by Guzmán and Watling (1978) and Guzmán (1983) are inappropriate taxonomic discriminators characters. Guzmán (1983) separated ***P. subaeruginosa*** from the other species by the distinctly pigmented brown dark cystidia, feature absolutely absent in the other species. These latter species are defined by the size and form of the spores and cystidia, features of great taxonomic value in the genus. Confusedly, Chang and Mills concluded that "investigations of isozyme bands ..... should be approached with caution".

The epithet of the new species here described refers to the type locality's name.

ACKNOWLEDGEMENTS

The authors grateful acknowledge the authorities of their instituions for the facilities to this research. Guzmán and Bandala also thanks to Sistema Nacional de Investigadores at Mexico for the support given to their researches. One of the authors (Allen) express his gratitude to Mr. Richard Leffel of Beauty and Books of Seattle, Washington, for providing funding for his trip to Thailand. Biol. Leticia Montoya from Instituto de Ecología, and Dr. Roy

Watling of the Royal Botanic Garden, Edinburgh, kindly critically revised the paper.

REFERENCES

Allen, J.W., 1991. Commercial activities related to pshychoactive fungi use in Thailand. *Boston Mycol. Club News 46* : 11-14.

Allen, J.W. and M.D. Merlin, 1992a. Psychoactive fungi use in Koh Samui and Koh Pha-Ngan, Thailand. *Jour. Ethnopharmacology 35* : 205-208.

Chang, Y.S. and A.K. Mills, 1992. Re-examination of ***Psilocybe subaeruginosa*** and related species with comparative morphology, isozymes and mating compatibility studies. *Mycol. Res. 96* : 429-441.

Cox, P.A., 1981. Use of an hallucinogenic mushroom in Samoa. *Jour. Ethnopharmacology 4* : 115-116.

Guzmán, G., 1983. *The genus Psilocybe.* Beih. Nova Hedwigia 74, Cramer, Vaduz.

Guzmán, G., V.M. Bandala and C. King, 1991. A new species of ***Psilocybe*** of Section ***Zapotecorum*** from New Zealand. *Mycol. Research 95* : 507-508.

Guzmán, G. and R. Watling, 1978. Studies in Australians Agarics and Bolets, I. Some species of *Psilocybe. Notes Roy. Bot. Gard., Edinb. 36* : 199-210.

Schultes, R.E. and A. Hoffmann, 1973. *Botany and chemistry of the hallucinogens.* Ch. C. Thomas, Springfield.

MYCOTAXON

Volume XLVI, pp. 161-170 January-March 1993

FURTHER OBSERVATIONS ON THE GENUS *PSILOCYBE* FROM NEW ZEALAND

Gastón Guzmán Victor M. Bandala
INSTITUTO DE ECOLOGÍA
APARTADO POSTAL 63
XALAPA, VERACRUZ 91000
MEXICO

and

Chris C. King
THE UNIVERSITY OF AUCKLAND
PRIVATE BAG AUCKLAND
NEW ZEALAND

SUMMARY

Four new records of ***Psilocybe*** were studied, ***P. australiana*** Guzmán & Watling and ***P. eucalypta*** Guzmán & Watling, both previously known from Australia, and ***P. semilanceata*** (Fr. : Secr.) Kumm. and ***P. coprophila*** (Bull. : Fr.) Kumm. both widely distributed species. Other studied material probably represents a new species belonging to the Section Semilanceatae. At present there are eight species of ***Psilocybe*** from New Zealand, all of them with psychotropic properties, except ***P. novae-zelandiae*** Guzmán & Horak and ***P. coprophila***.

INTRODUCTION

The fungi of New Zealand have been studied since the last century (Horak, 1973), but specific studies on the genus ***Psilocybe*** did not begin until 1978, when Guzmán and Horak (1978) described ***P. novae-zelandiae*** Guzmán & Horak, a non hallucinogenic species. Margot and Watling (1981) reported from New Zealand an unnamed blueing ***Psilocybe*** sp., with affinities to the North American ***P. caerulipes*** (Peck) Sacc. Recently Guzmán *et al.* (1991) described ***P. aucklandii*** Guzmán, King & Bandala, the first hallucinogenic species known from the archipelago.

Results from recent mycological trips in New Zealand by one of the authors (Ch.C.K.) and new information from herbarium material, motived the attention of the authors to present this paper.

All the specimens studied in this work are deposited in PPD and XAL Herbaria, except where otherwise cited.

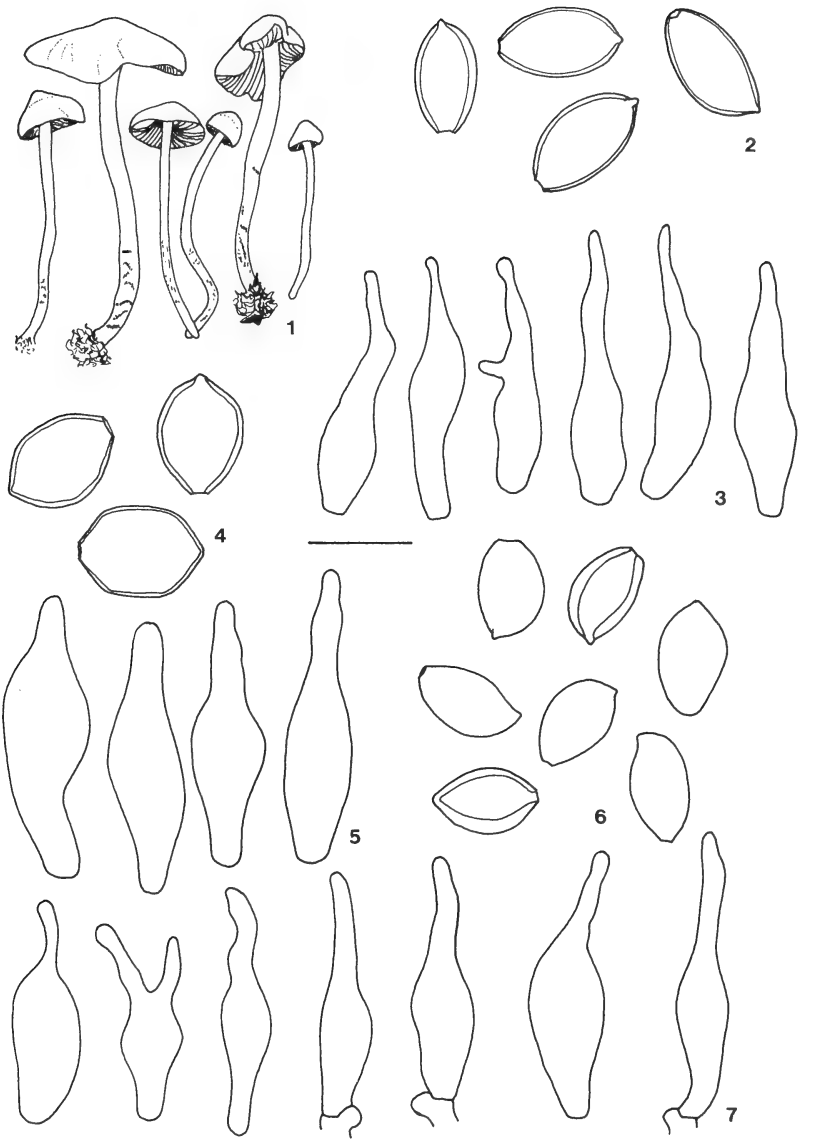
THE KNOWN SPECIES OF *PSILOCYBE* FROM NEW ZEALAND

There are eight species of ***Psilocybe*** known from New Zealand (table 1), of which ***P. novae-zelandiae***, ***P. aucklandii*** and ***Psilocybe*** sp. of Margot & Watling (1981) are the only previously reported species. All these taxa except for ***P. novae-zelandiae*** and ***P. coprophila*** (Bull. : Fr.) Kumm. probably have psychotropic properties.

P. novae-zelandiae was described by Guzmán and Horak (1978) from Mt. Grey in Canterbury and has not been reported again. ***P. aucklandii***, a fungus described in 1991 from the north of Auckland (Guzmán *et al.*, 1991), has not been found in any other part of New Zealand in spite of recent explorations made by King, who recently found more specimens from the type locality, a ***Pinus radiata*** Don plantation with native dicotyledonous trees. This new collection (a topotype) agrees well with the description of the type. Fig. 1 shows the basidiomes of the new collection.

NEW RECORDS OF *PSILOCYBE* FROM NEW ZEALAND

Stringer and Dunham collected several specimens of ***P. semilanceata*** (figs. 2-3) in the Inangahua junction, at the SE of Wakefield, in May of 1982, which they sent to Guzmán for study. These specimens were deposited in XAL Herbarium, but were not reported. This is the first record of ***P. semilanceata*** from New Zealand. It is a common hallucinogenic species widely distributed in temperate regions. Guzmán (1983) reported it from Canada, the U.S.A., Chile, Europe (from 13 countries), and from Tasmania. Probably it was introduced to Chile, New Zealand and Tasmania. It is interesting to note that this fungus has not be found in Mexico, in spite of the large number of ***Psilocybe*** species found there (about 40 species recorded until 1988) (Guzmán *et al.*, 1988).

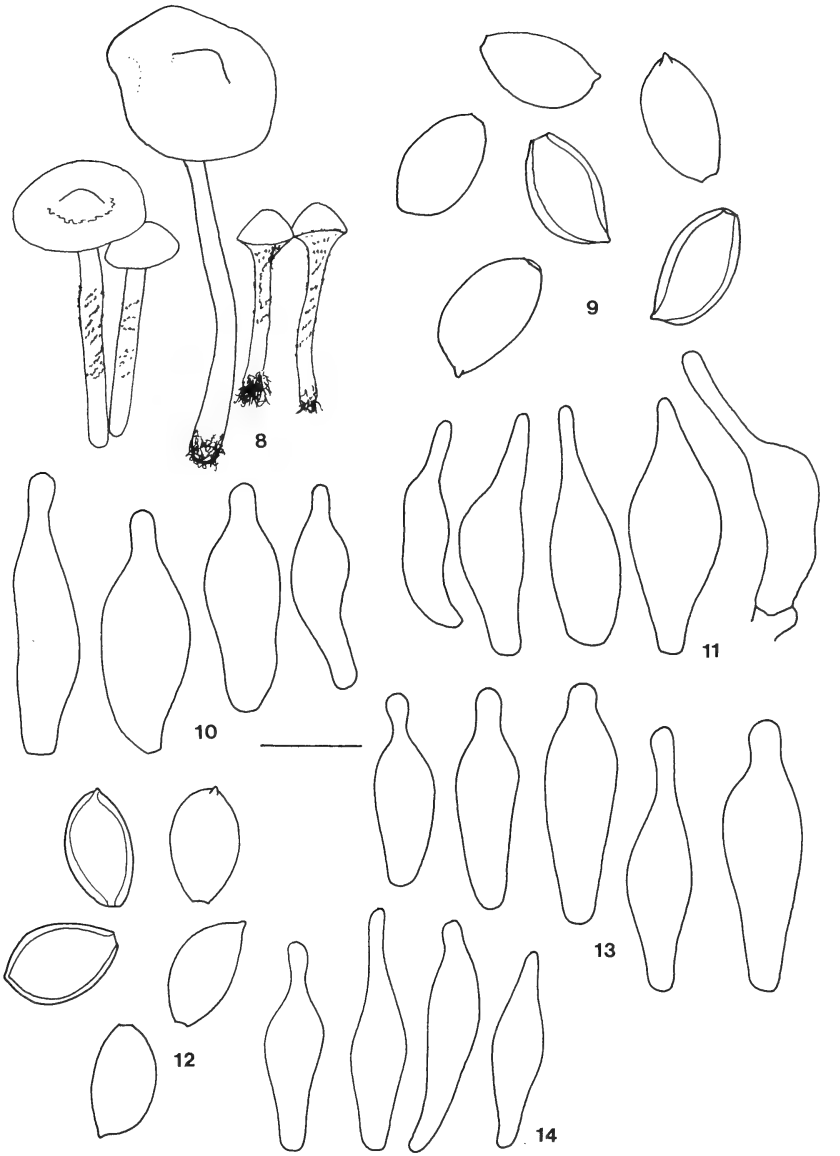


Figs. 1-7.- 1: ***Psilocybe aucklandii***, basidiomes. 2-3: ***Psilocybe semilanceata***, 2: spores; 3: cheilocystidia. 4-5: ***Psilocybe coprophila***, 4: spores; 5: cheilocystidia. 6-7: ***Psilocybe* sp.**, 6: spores; 7: cheilocystidia (scale bar = 10 μm, except 1 = 20 mm).

P. coprophila was collected also by Stringer and Dunham in May of 1982 in New Zealand, near Wakefield, in Waimen Plains, and sent to Guzmán for study. Figs. 4-5 show the spores and cheilocystidia of this species. ***P. coprophila*** has a wide distribution in the world (tropical, subtropical or temperate regions). It has been reported from 21 countries in America, Europe and Asia, in addition to Australia and Papua New Guinea (Guzmán, 1983). This species frequently is miss identified as a hallucinogenic fungus (Allen *et al.*, 1991).

King collected in May of 1990 in the Moehau Range region (see fig. 15) an interesting bluing specimen of an unidentified ***Psilocybe***. The important features of this material are: spores 8.8-9.6 (-10.4) x (4.8-) 5.6-6.4 μm, short ellipsoid both in face- and side-view, or sometimes faintly subrhomboid in face-view, with thick-wall (up to 0.8 μm); basidia 24-32 x 7.2-8 (-9.6) μm, 4-spored; pleurocystidia absent; cheilocystidia (12-) 16-24 (-25.6) x 4.8-6.4 (-7.2) μm, abundant, bottle shaped or sublageniform, with a flexuous neck, sometimes irregularly bifurcate; subhymenium with elongated or subglose elements; trama subregular, with hyaline hyphae, and gelatinized epicutis with elongated hyaline hyphae, 1.6-4 μm thick, frequently wrinkled or in spiral (Figs. 6-7).

According to the thick-walled spores, absence of pleurocystidia and bluing of the basidiomes, this species belongs to Section Semilanceatae, but differs from ***P. semilanceata*** by the more or less convex or short subumbonate pileus, and by the size of the spores and cheilocystidia [(11-) 12-14 (-16) (-18) x (6-) 7-8 (-9) μm and 18-32 (-35) x (4.5-) 5-8 μm, respectively]. Another two related species are ***P. callosa*** (Fr. : Fr.) Quél. which differs in its cheilocystidia 21-46 (-50) μm long and spores (8.5-) 10-12 (-13.5) μm long, and ***P. caerulipes*** (Peck) Sacc. which has narrower spores, (7-) 8.2-9.9 (-11) x 3.8-5.5 (-6) μm, and longer cheilocystidia, 18-35 x 4.5-7.5 μm. The latter is known only from eastern U.S.A. and Mexico. ***Psilocybe*** sp. reported by Margot and Watling (1981) from New Zealand is independent from King's collection, but close to ***P. caerulipes***, because according to these authors it has spores 7.7-8.8 x 5.5-6 μm. Probably King's specimens belong to a new species, but due to the scarce collections we prefer to reserve its description.



Figs. 8-14.- 8-11: ***Psilocybe australiana***, 8: basidiomes; 9: spores; 10: pleurocystidia; 11: cheilocystidia. 12-14: ***Psilocybe eucalypta***, 12: spores; 13: pleurocystidia; 14: cheilocystidia (scale bar = 10 μm, except 8= 15 mm).

P. australiana and ***P. eucalypta*** are new records for New Zealand. They were described from Australia by Guzmán and Watling (1978). ***P. australiana*** was found in the west of Auckland in April of 1987 growing on a rotten bamboo. The studied specimens agree well with the original description (Guzmán & Watling, 1978). The spores are (10.4-) 11.2-13.6 x 6.4-7.2 μm, with a thick wall of 0.8 μm; basidia 32-36 x 8-9 μm; pleurocystidia (20-) 21.6-28 (-31.2) x (5.6-) 7.2-9.6 μm, abundant but difficult to observe; cheilocystidia 18.4-25.6 x 6.4-8 (-8.8) μm, abundant; trama subregular, and epicutis subgelatinized, with postrated 2.4-4 (-4.8) μm thick, hyaline hyphae, sometimes with granulations on the walls (figs. 8-11).

P. eucalypta differs from ***P. australiana*** by the size of the spores, (8.8-) 9.6-11.2 (-12) x (4.8-) 5.6-6.4 μm. The studied materials exhibit basidia 24-28 (-36) x 8-9.6 μm; pleurocystidia 20-24 x 5.6-8.8 μm and cheilocystidia 20-24 x (4-) 5.6-8 μm (figs. 12-14). The specimens were collected in the NW of New Plymouth in May, on decomposing wood. Both ***P. australiana*** and ***P. eucalypta*** are hallucinogenic mushrooms and they are very close to the European and North American ***P. cyanescens*** Wakefield of which they differ by the spores and cheilocystidia (Guzmán, 1983).

Chang and Mills (1992) considered ***P. australiana*** and ***P. eucalypta*** as synonyms of ***P. subaeruginosa*** Clel., according to an isozyme analysis and in a confused comparative morphology and mating study of specimens collected in Tasmania, but as Guzmán (1983) and Guzmán *et al.* (1992) concluded, ***P. subaeruginosa*** is an independent species, defined by its dark brown pigmented cystidia, a feature absent in other species, as well as in ***P. tasmaniana*** Guzmán & Watling. All these species except ***P. subaeruginosa*** are separated by the size of cystidia and spores.

Figure 15 shows the localities of the discussed species of ***Psilocybe*** in New Zealand, except for ***P.*** sp. from Margot & Watling (1981).

Table 1. The known species of *Psilocybe* from New Zealand *

Section Coprophilae

P. coprophila (Bull. : Fr.) Kumm.

Studied material : loc. 5, May 12, 1982, *Stringer & Dunham 3* (PDD; XAL).

Section Cyanescens

P. australiana Guzmán & Watling

Studied material : loc. 3, April 1987, *King 2* (PDD; XAL).

P. eucalypta Guzmán & Watling

Studied material : loc. 4, May 1990, *King 5* (PDD; XAL).

Section Pratensae

P. novae-zelandiae Guzmán & Horak

Studied material : loc. 7, Sept. 15, 1967, *Horak s.n.* (Holotype PDD, Isotypes ZT & ENCB).

Section Semilanceatae

P. semilanceata (Fr. : Secr.) Kumm.

Studied material : loc. 6, May 16, 1982, *Stringer & Dunham 6* (PDD, XAL).

Psilocybe sp.

Studied material : loc. 2, May 15 1990, *King 4* (PDD, XAL).

Psilocybe sp.

Reported by Margot and Watling (1981) with affinities to ***P. caerulipes*** (Peck) Sacc.

Section Zapotecorum

P. aucklandii Guzmán, King & Bandala

Studied material : loc. 1, June 1989, *King s.n.* (Holotype PDD; Isotype XAL); May 1, 1990, *King s.n.* (PDD, XAL).

* The numbers of the localities refer to those in the map of fig. 15

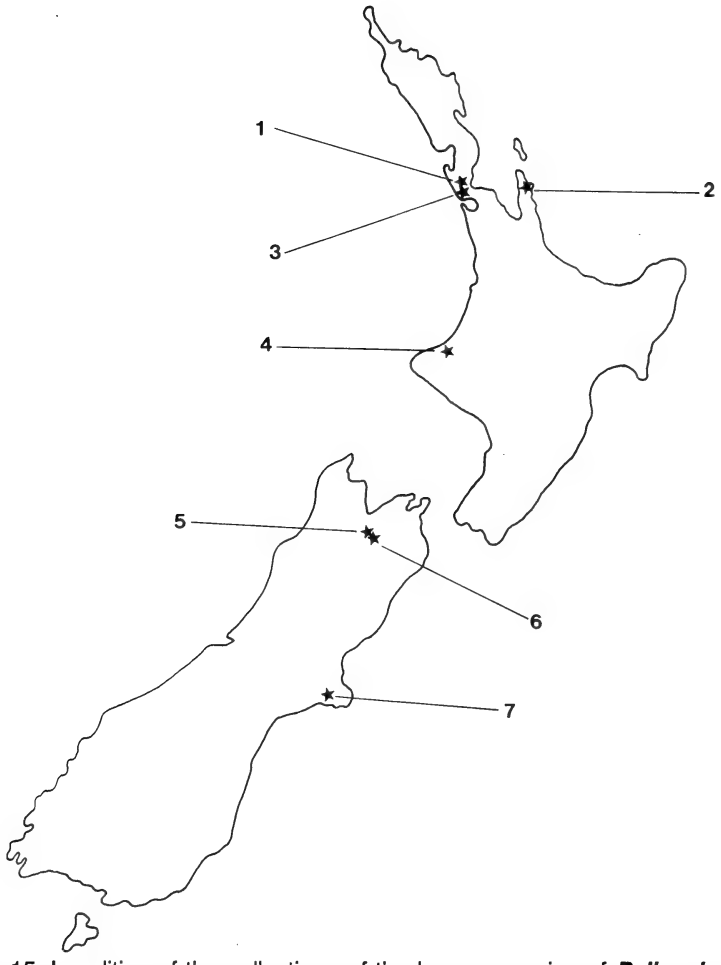


Fig. 15. Localities of the collections of the known species of ***Psilocybe*** from New Zealand (except that of ***P.*** sp. from Margot and Watling, 1981). 1: 25 km N of Auckland, Wood Hill State Park (***P. aucklandii***), 2: Moehau Range, Port Charles, near Colville (***P.*** sp.), 3: 20 km West of Auckland, near Oratia (***P. australiana***), 4: NW of New Plymouth (***P. eucalypta***), 5: Waimen plains, near Wakefield (***P. coprophila***), 6: SE of Wakefield, Inangahua junction (***P. semilanceata***), and 7: Canterbury, Mt. Grey, Kowai Bush (***P. novae-zelandiae***).

ACKNOWLEDGEMENTS

The authors are grateful to the authorities of both the Instituto de Ecología and the University of Auckland for their support to this work. Biol. Leticia Montoya from the Instituto de Ecología and Dr. Roy Watling of the Royal Botanic Garden at Edinburgh kindly revised this paper. They also thank Dulce Murrieta and Fidel Tapia technicians at the XAL Herbarium for their help.

REFERENCES

Allen, J.W., M.D. Merlin and K.L.R. Jansen, 1991. An ethnomycological review of hallucinogenic agarics in Australia and New Zealand. *Jour. Psychoactive Drugs 23* : 39-69.

Chang, Y.S. and A.K. Mills, 1992. Re-examination of ***Psilocybe subaeruginosa*** and related species with comparative morphology, isozymes and mating compatibility studies. *Mycol. Res. 96* : 429-441.

Guzmán, G., 1983. *The genus **Psilocybe***. Beih. Nova Hedwigia 74, Cramer, Vaduz.

Guzmán, G., V.M. Bandala and C. King, 1991. A new species of ***Psilocybe*** of Section Zapotecorum from New Zealand. *Mycological Research 95* : 507-508.

Guzmán, G., V.M. Bandala and C. King, 1992. Further observations on the genus ***Psilocybe*** from New Zealand. *Mycotaxon* (in press).

Guzmán, G., L. Montoya-Bello and V.M. Bandala-Muñoz, 1988. Nuevos registros de los hongos alucinógenos del género *Psilocybe* en México y análisis de la distribución de las especies conocidas. *Rev. Mex. Mic. 4* : 255-265.

Guzmán, G. and E. Horak, 1978. New species of ***Psilocybe*** from Papua New Guinea, New Caledonia and New Zealand. *Sydowia 31* : 44-54.

Guzmán, G. and R. Watling, 1978. Studies in Australian Agarics and Bolets, I. Some species of ***Psilocybe***. *Notes Roy. Bot. Gard., Edinb.* 36: 199-210.

Horak, E., 1973. *Fungi Agaricini Novazelandiae I-V.* Beih. Nova Hedwigia 43, Cramer, Lehre.

Margot, P. and R. Watling, 1981. Studies in Australian agarics and bolets. II. Further studies in ***Psilocybe***. *Trans. Br. Mycol. Soc. 76* : 485-489.

MYCOTAXON

Volume XLVI, pp. 171-199 January-March 1993

ALTERNARIA THEMES AND VARIATIONS (54-62)

EMORY G. SIMMONS

717 Thornwood Road, Crawfordsville, IN 47933

ABSTRACT

In continuation of a series of papers primarily on *Alternaria* (Simmons 1981 et seq.), six species of *Alternaria* isolated from and reportedly pathogenic to species of *Passiflora* are discussed. The original characterization of filament-beaked *A. passiflorae* Simmonds is revised to exclude impertinent attributes that belong instead to a non-type specimen and culture of another species, included inappropriately in the type description but segregated and described here as new: *A. aliena* E. Simmons, sp. nov. Three other filament-beaked species also are described as new on the basis of isolates from Florida and Hawaii: *A. aragakii* E. Simmons, *A. hawaiiensis* E. Simmons, and *A. tropica* E. Simmons. An unnamed member of the *A. tenuissima* group of species is characterized because of its history of pathogenicity to *Passiflora edulis* Sims. Two additional new species with erostrate conidia are described from unique specimens of passion fruit: *A. obclavoidea* E. Simmons from Colombia and *A. latifunda* E. Simmons from Hawaii. Illegitimate "*Alternaria passiflorae* Sawada" is discussed for the record.

X. SOME ALTERNARIA SPECIES ON PASSIFLORA

Introduction

More than one species of *Alternaria* that produces relatively large conidia with long tapered or filamentous beaks is associated with lesions of *Passiflora edulis* Sims (passion fruit) and other species of this large tropical genus. Comparison in culture of an accumulation of isolates from these hosts supports this view, which, however, is not novel with me, for Rosenberg (1962) summarized investigations

at the Hawaii Agricultural Experiment Station on the pathogenicity of isolates identified, without author attribution, as *A. passiflorae*, *A. tomato*, and *A. tenuis* [cfr. *A. alternata* (Fries) Keissler]). His report also contained a few details of the effects of light, nutrition, and temperature on the sporulation of *A. tomato*, apparently in summary of work of Aragaki (1961, 1962) at the same institution. Dr. Aragaki has shared with me several of his strains of *Alternaria* from *Passiflora*, some with species determinations, others not: *A. passiflorae* Simmonds, *A. tomato* (Cooke) L. R. Jones, "*A. tenuis*," and an *Alternaria* sp. indet. All of these strains, with the exception of the short-beaked "*A. tenuis*," produce relatively large, long-rostrate conidia. None of them is typical *A. passiflorae* or *A. tomato*.

The working identifications placed on the numerous isolates from passion fruit plants given to me by Dr. Aragaki reveal that he recognized three morphologically distinct, long-beaked *Alternaria* species from this host. Additional isolates, similar in a large-spore sense, have been available from Kenya, New Zealand, and the continental U.S.A. (Florida). These several isolates plus pertinent herbarium specimens in the U.S. Department of Agriculture National Fungus Collections (BPI), C.A.B. International Mycological Institute (IMI), and the Royal Botanic Gardens, Kew (K), are discussed here in an attempt to unravel a complex taxonomic problem stemming from morphologically diverse, reputedly pathogenic *Alternaria* species that may occur on several parts of this tropical vine. A few *Alternaria* taxa resident on *Passiflora* species but of unknown pathogenicity are included to round out the picture as currently known.

Conventions employed in the following discussion are for the most part the same as those listed in earlier papers of this series (cfr. Simmons 1990): herbarium and culture collection abbreviations are as listed in Holmgren et al. (1990), appearing here in boldface type, e.g., **BPI**; references to my records of material studied are in book-page format, e.g., EGS 11-016; culture conditions include PCA, Hay decoction, and V-8 juice agars in plastic Y-plates at ca. 22C under a cool-white fluorescent light/dark, 10/14 hr cycle; microscopic details are recorded from observations made at 780X (not the erroneous "500X" stated in Simmons 1990).

Historical Background

In 1938 J. H. Simmonds reviewed the few known reports

of observations on a fungus associated with a brown spot disease of the passion fruit vine, *Passiflora edulis* Sims, in Australia. According to him, early papers (including Simmonds 1930) ascribed the disease to a species of *Macrosporium*; later ones, following the advice of S. P. Wiltshire (in litt. to Simmonds), referred the fungus to *Alternaria* (Simmonds 1936) and eventually to *A. passiflorae* Simmonds (1938) as a new species.

Simmonds had sent "cultures and herbarium material to the Imperial Mycological Institute," where S. P. Wiltshire examined the material and commented on it in his letter dated 9 June 1933. Simmonds, in the publication of his new species typified by a different specimen (deposited K), quoted Wiltshire's observations, though "slightly amended," thus incorporating them in the original concept of the species, which has come down to us almost unchanged in the derivative literature on the taxon.

Wiltshire's observations, as recorded by Simmonds, were based on examination of cultures; it remains unclear whether Simmonds verified critical characteristics mentioned by Wiltshire or simply included them in some unspecified modified form in his own type description. This ambiguity requires examination in the present, in that the field collection and a derivative dried-down culture studied by Wiltshire (IMI 81,840 ex Simmonds 2493, dtd 26-8-32) is different and earlier than the "type material. . .lodged with the Kew Herbarium" (Simmonds 1938), which is K, *Alternaria passiflorae* Simmonds, Simmonds 5205, 20.XII.37, "Type material."

An additional complication, making the specific determination of filament-beaked *A. passiflorae* difficult, is the fact that more than one large-spored species of *Alternaria* is known from species of *Passiflora*. More importantly, from a diagnostic viewpoint, I have been unable to induce modern isolates to sporulate in culture in a manner that would support Wiltshire's statement that the cultures he studied produced both a kind of filament-beaked conidium peculiar to *A. passiflorae* and "chains of five spores" (Wiltshire in litt. to Simmonds, 1933), a statement reiterated, but not illustrated, by Joly (1964), M. B. Ellis and P. Holliday (1970), and M. B. Ellis (1971).

Characteristics of Typical *A. passiflorae*

54. **Alternaria passiflorae** Simmonds Figs. 52, 53

The type characterization of *A. passiflorae* (Simmonds 1938) must be associated in the first instance with the extant holotype specimen that was deposited in the herbarium of the Royal Botanic Garden (K, Simmonds 5205; EGS 11-016). Accessory information based on other specimens and cultures, if it is demonstrably at odds with that of the type, must be emended or deleted from the type description. This is the case with the type description of *A. passiflorae*. I have attempted to clarify and correct the situation below.

Reexamination of the type specimen (Fig. 52) yields a description much in accord with that of Simmonds except for characters specifically noted by him as having been observed in culture (conidium beaks with 1-5 branches; conidia in chains of 2-5). My observations, limited to a single slide preparation from the type, encompass conidiophores that are rather coarse, brown, 3-5-septate, up to 100 x 10 μm, with a terminal and 2-4 precedent conidiogenous sites that have become lateral at inconspicuous geniculations; and conidia that initially are narrowly ovoid and erostrate, becoming long obclavate as they produce a long filamentous beak, with smooth outer walls, smoothly constricted at 6-9 transverse septa, without longitudinal septa or with one longitudinal septum in each of 1-3 of the transverse compartments, 55-90 x 14-24 μm (body), medium yellowish brown in color (after 20 years under herbarium conditions and subsequent 35 years in the lactic acid of the slide preparation), mostly with a single filamentous beak 60-170 x 2-3 μm but occasionally with a single one-branched beak. The longest conidium found is 250 x 20 μm (body 80 μm + beak 170 μm), although most rostrate conidia in the sample are in a length range of 150-185 μm.

These observations are not at variance with the photographic illustrations that accompanied the Simmonds type description (1938, Plate VI) except that no conidium with a branched beak appears there. Other field specimens that can be identified with this description include at least **BPI** US0445819, on *Passiflora ligularis*, L. B. Loring, June 23, 1951, Oahu, Hawaii (EGS 40-195); **IMI** 104521a, on *Passiflora edulis*, S.A.L. 3321, Sotik, Kenya, 16-12-63 (EGS 24-031); and **IMI** 115356, on *Passiflora allardii*, P.P.N.R. 4755, Lusaka, Northern Rhodesia, 8-3-63 (EGS 24-027).

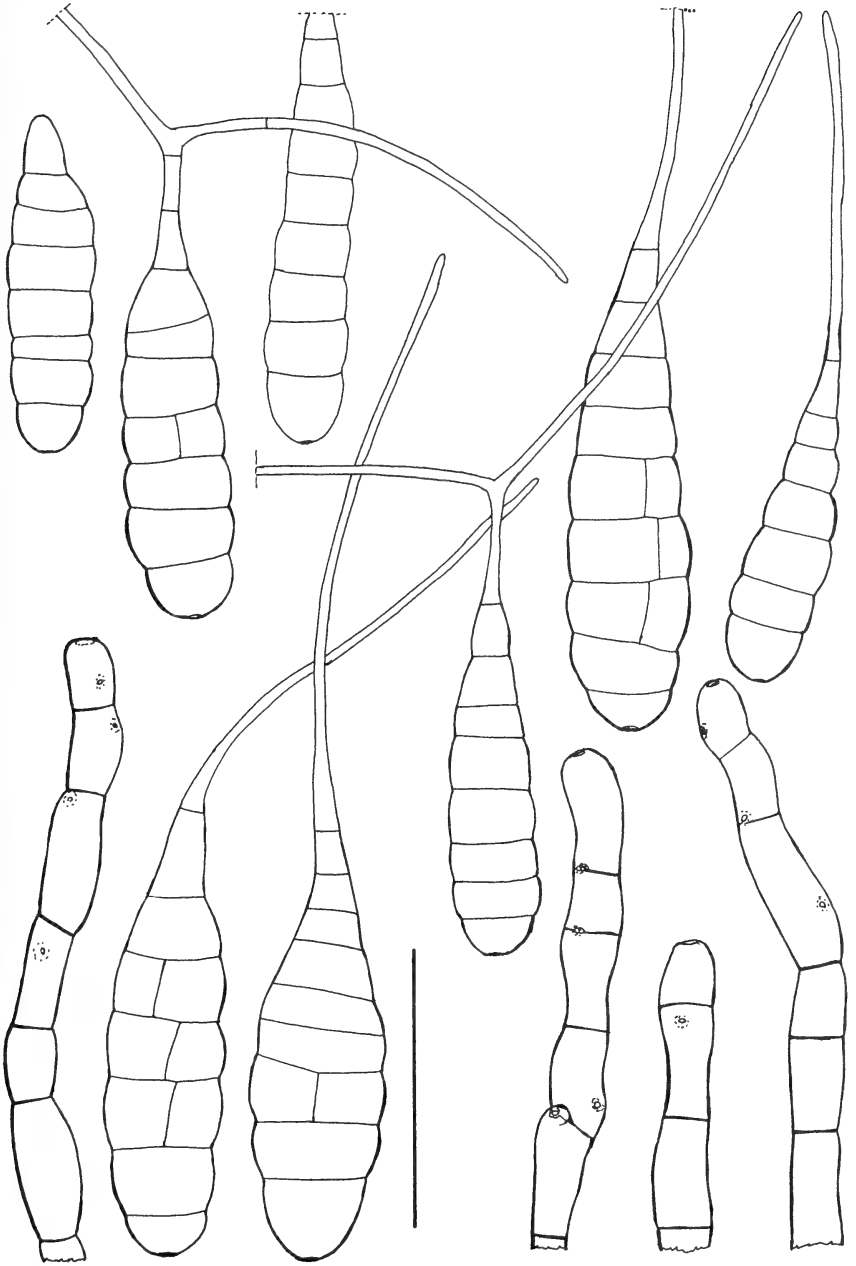


Fig. 52. Alternaria passiflorae; conidia and conidiophores from Holotype. Magn.: bar = 50 μm.

This characterization of the species as it appears in typical field material must be modified somewhat when structures produced in culture are encountered, as in EGS 16-150, an isolate ex F. J. Morton A-117(1) from fruit of *Passiflora edulis*, Auckland, New Zealand, 6-2-63 (Fig. 53). Conidiophores produced on V-8 agar are remarkably large, coarse, and deeply pigmented (as in the type). Conidia produced under the same conditions have spore bodies in the range of 70-80 x 14-22 μm plus beaks reaching 145-190 μm in length when they are unbranched; they are a dilute yellow-tan; and body shape, contour, septation, and lack of wall ornamentation are much as they are in type conidia. However, in culture the beak architecture exhibits some strikingly different features: (1) a high percentage of beaks on conidia produced within a week after inoculation are long, narrow, and unbranched, as in the field type; but (2) an almost equally high percentage of beaks produced in the same time period are multiple (2-5, commonly 4), arising individually on a series of swellings derived from the apical cell of the conidium body and they themselves sometimes becoming bifurcate and meagerly septate; and (3) the elongation of the filamentous beak of a very small percentage of conidia terminates when its tip converts into an enlarged secondary conidiophore and secondary long-beaked conidium.

The character of multiple-beaked conidia in cultures of *A. passiflorae* was recorded by Simmonds ("rostrum hyalinum. . ., in culturis observatum, 1-5 ramosum") and implied by Wiltshire in his letter to Simmonds ("a tendency for the base of the beak of spores formed in culture to become zig-zag"). The phenomenon, easily demonstrable and striking on PCA and V-8 agars for typical *A. passiflorae* isolates, is encountered also in *A. anagallidis* Raabe (Raabe 1938), *A. multirostrata* Simmons & Jackson (Jackson and Simmons 1968), and *A. dichondrae* Gambogi, Vannacci & Triolo (Gambogi et al. 1975).

If this discussion of *A. passiflorae* in its typical field specimen and culture aspects could end here, it is likely that anyone examining sporulating specimens and isolates of *Alternaria* from passion fruit plants could segregate this species correctly. However, as mentioned in historical remarks above, Wiltshire wrote to Simmonds: "Your species I have observed to form chains of five spores in culture. . .." Simmonds included this information in his type description, and later authors (cited above) have noted such a character in their treatments of the species.

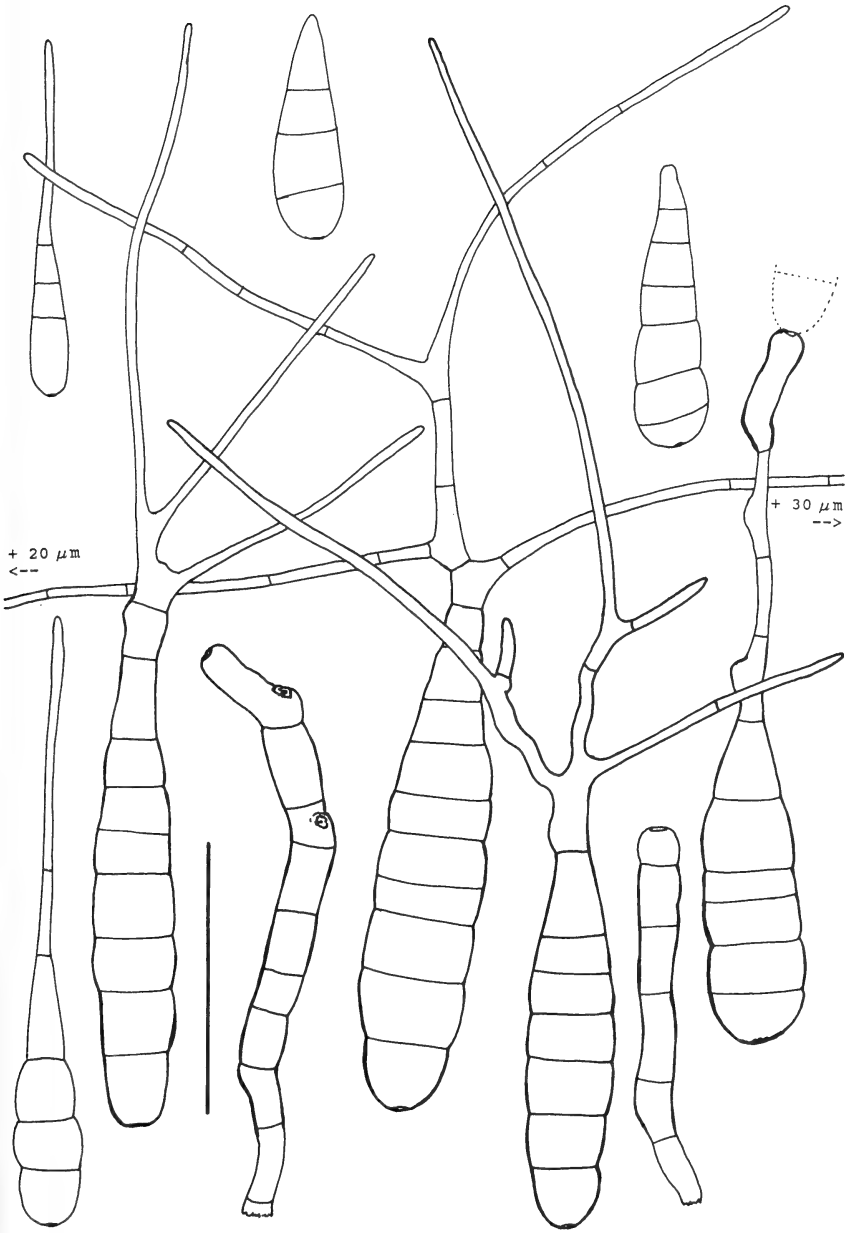


Fig. 53. Alternaria passiflorae; conidia and conidiophores from representative isolate (EGS 16-150). Magn.: bar = 50 µm.

For many years I have doubted the accuracy of this statement as applied to chain proliferation in typical *A. passiflorae*, having had the opportunity to study six of F. J. Morton's *A. passiflorae* isolates from fruit and leaf spots as they occurred on *Passiflora edulis* in New Zealand in 1963. "Chains of five spores" (or four, or three) never have been seen by me to occur in cultures of these strains. The discrepancy between observations can be resolved only if material studied by Wiltshire can be examined. Fortunately, such material has been conserved in herbarium IMI. It is used here to typify a species morphologically distinct, both in nature and in culture, from *A. passiflorae*, from whose type description and later treatments the notion of vigorous chain production needs to be excised.

55. **Alternaria aliena** E. Simmons

The herbarium packet IMI 81,840 contains the Simmonds material that is pertinent to Wiltshire's observations on chains of conidia in isolates from *Passiflora* (IMI 81,840, Simmonds 2493, *Passiflora edulis*, North Tamborine, Queensland, Australia, 28-8-32; EGS 22-117). The packet contains leaves with moderately large, brown lesions and a dried-down culture, each with enough sporulation elements to support comparison with other collections and isolates. (The dried culture substrate is quite transparent and is thought to have been clear maize meal agar.)

Many conidia on this early leaf specimen have developed sturdy, gradually tapered beaks of moderate length that show no tendency to become long and filiform (Fig. 54). Conidia with a beak converted into an apical secondary conidiophore are readily found; they constitute about 5% of the conidium sample examined. Conidia found in the growth of the dried-down culture are very similar in morphology to those on the field specimen, except that most of the largest conidia in the dried culture have an apical secondary conidiophore and, therefore, were borne in chains, as Wiltshire observed.

Since there is no other IMI specimen that can be associated with the Simmonds-Wiltshire correspondence prior to publication of *Alternaria passiflorae*, I am led to conclude that two different species of *Alternaria* were included among the "cultures and herbarium material" sent to Wiltshire. One of them, apparently lacking a voucher specimen at IMI, probably was multirostrate *A. passiflorae*

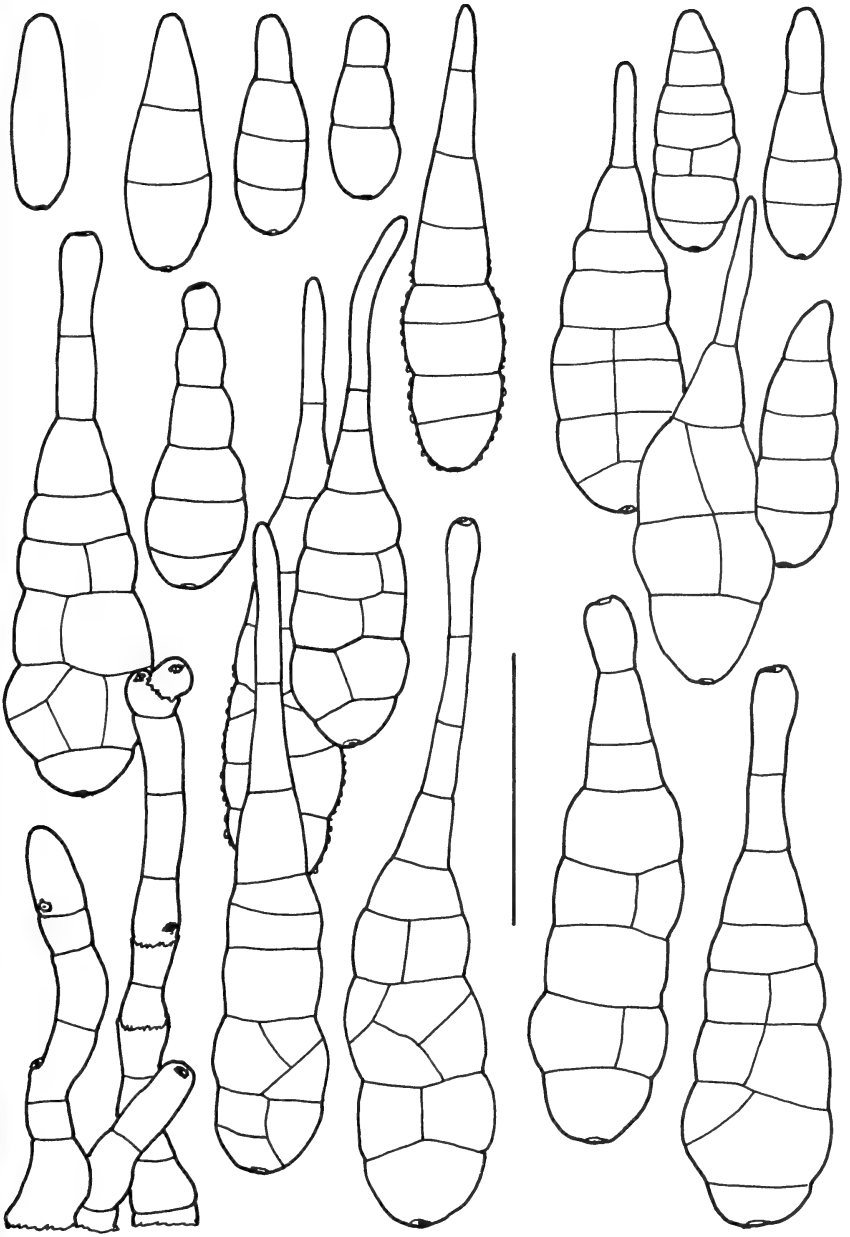


Fig. 54. Alternaria aliena; conidia and conidiophores from Holotype (left of bar) and a derivative dried culture (right of bar). Magn.: bar = 50 μm.

with the peculiar zig-zag appearance of the beak base of many conidia, as was noted by Wiltshire. The second quite different species, with its sturdy beaks and facility in production of chains of conidia both in nature and in culture, is represented by IMI 81,840, described below as novel with characters and type specimen alien to those of typical *A. passiflorae*.

Alternaria aliena E. Simmons, sp. nov. Fig. 54

Ex specimine naturali descripta. Conidiophora simplicia, 25-100 x 7-10 µm, subhyalina ad avellanea, locis conidiogenis 1-5. Conidia initio ellipsoidea vel ovoidea, erostrata, laevia vel parum depresse pustulata; dein rostrata vel apicaliter conidiogena; maturitate obclavoidea, laevia vel depresse pustulata, dilute straminea, 85-130 x 18-25 µm, 6-9 transverse et 1-4 longitudinaliter septata. Conidia singularia vel plerumque catenata. Habitatio typi in folio maculato Passiflora edulis Sims, Queensland, Australia. Holotypus: IMI 81,840, Simmonds 2493, North Tamborine, Queensland, Australia, 28-8-32 (EGS 22-117).

Alternaria aliena can be thought of as a member of the *A. sonchi* Davis group of species (Elliott 1917), with comparatively large-celled, apically blunt or broadly tapered conidia that are solitary or that often occur in short, unbranched chains, particularly in culture. *A. dianthicola* Neergaard and *A. euphorbiicola* Simmons & Engelhard have similar group characteristics (Simmons 1992).

M. Aragaki *Alternaria* Isolates from *Passiflora*

In 1968 and additionally in 1982 Dr. M. Aragaki (University of Hawaii, Honolulu) shared with me his isolates of *Alternaria* from Hawaiian plant substrates, among which were eight strains from species of *Passiflora*. Seven of these have survived the years as freeze-dried preparations and have been retrieved as cultures with good to excellent sporulation and plate-growth stability.

Four of the isolates are of the *Alternaria* species that Aragaki used experimentally in his studies of the effects of physical and physiological factors on sporulation (Aragaki 1961, 1962, 1964a, 1964b) and that he called *A. tomato* (Cooke) Weber (cfr. *A. tomato* (Cooke) L. R. Jones); see Sect. 56 below. Two others were considered by him to represent *A.*

passiflorae (Sect. 57). Another was segregated by him as an *Alternaria* sp. indet. for which the "Pathogenicity has been worked out" (Sect. 58). The eighth was cited as "*A. tenuis*" (Sect. 59).

All of these except for the one presented as *A. tenuis* (cfr. *A. alternata*) produce relatively large conidia with moderately long to very long tapered or filamentous beaks. Aragaki recognized three different patterns of sporulation and conidium morphology among these isolates, as do I. None of the three species, however, can be identified with typical *A. passiflorae* or with typical *A. tomato*.

56. **Alternaria aragakii** E. Simmons

Alternaria tomato (Cooke) L. R. Jones, considered to be the incitant of erstwhile commercially significant nailhead spot disease of tomato, has been misunderstood taxonomically and, therefore, has been misidentified by most mycologists and phytopathologists. (See below: **Note on *Alternaria tomato***.) The pertinent isolates studied by Aragaki are not *A. tomato*. They are treated here as representatives of a new species, described in the context of other passion fruit pathogens and named for M. Aragaki in acknowledgement of his contributions to this field of study.

Alternaria aragakii E. G. Simmons, sp. nov. Fig. 55

*Ex culturis in agaro V-8 descripta. Conidiophora simplicia vel ramosa, locis conidiogenis uno vel pluribus. Conidia initio longiovoidea vel longe subellipsoidea, erostrata, aliquantum papulosa; dein rostrata, verrucosa; maturitate longiellipsoidea, longirostrata, dense depresse pustulata, fumosistraminea, septis atratioribus, 7-13 transverse et 0-7 longitudinaliter septata, usque ad 200 x 19 µm (corpore 70-100 x 15-19 µm + rostro 40-100 µm), 8-14 transverse et 4-7 longitudine septata. Conidia singularia vel sporulatio raro in catenis simplicibus conidiorum 2-4. Habitatio typi in fructu Passiflora edulis Sims, Hawaii, U.S.A. Typus: partes ex EGS 29-016 (ex isol. M. Aragaki no. AT9) desiccatae et in **BPI** (holotypus) et pro isotypis saltem in **IMI** et **NY** conservandae.*

Conidiophores arise directly from the agar substrate surface or from lanose aerial mycelium; they are simple or sometimes branched and often are extraordinarily long when

secondary growth occurs beyond the geniculation of a primary conidiogenous site, 80-200(-500) x 7 μm. Ovoid to long-ellipsoid juvenile conidia are a dilute, greyed straw color and smooth or, frequently, somewhat rough. Conidia may produce a filamentous beak at an early stage, but more commonly they reach nearly full size, color, and ornamentation, with 5-10 transverse septa, before the apical cell initiates production of its filamentous beak. Conidia become as large as 200 x 19 μm, with a spore body 70-100 x 15-19 μm plus the beak 40-100 x 2 μm, and with 8-14 transverse septa and 1-3 longitudinal septa in each of 4-7 of the transverse divisions. The conidium body in all but the youngest stages is distinctly ornamented, becoming densely punctulate roughened to depressed pustulose overall; outer walls are a dilute, dull straw color, and transverse septa are distinctly darker. Conidia rarely occur in chains on V-8 agar under routine culture conditions; perhaps one conidium per 300 or more in a slide mount has an apical secondary conidiophore and therefore occurred in a chain. No instance of branched or multiple beaks has been seen in hundreds of *A. aragakii* conidia scanned.

Examples of *A. aragakii* known to me are four isolates represented by cultures received from M. Aragaki in October 1968, all from passion fruit: EGS 29-013, ex Aragaki 32; EGS 29-014, ex Aragaki 32W (isolated by Aragaki from an albino sector of Aragaki 32; typical in culture and morphology, except for lack of pigment and lack of cell wall ornamentation discernible at 780X); EGS 29-015, ex Aragaki AT4; and EGS 29-016, ex Aragaki AT9 (source of holotype).

Note on ***Alternaria tomato***, to which these four isolates from passion fruit originally were referred (Aragaki 1961, 1962, 1964a, 1964b).

The descriptive literature on *A. tomato* is difficult to sort out, and especially so in that proposals for combining the epithet of *Macrosporium tomato* Cooke (1883) with *Alternaria*, plus related observations on diverse *Alternaria* inhabitants of tomato plants, have been published five times by four different authors: L. R. Jones, 1896; Brinkman, 1931; G. F. Weber twice, 1934 and 1939; and Ciferri, 1962. On the basis of comments made by these several authors in the places cited, it is easy to conclude that none of them except Weber was dealing with a fungus similar to that originally published on by Cooke. *A. tomato* (Cooke) L. R. Jones (attributing the name to the earliest combiner, even though

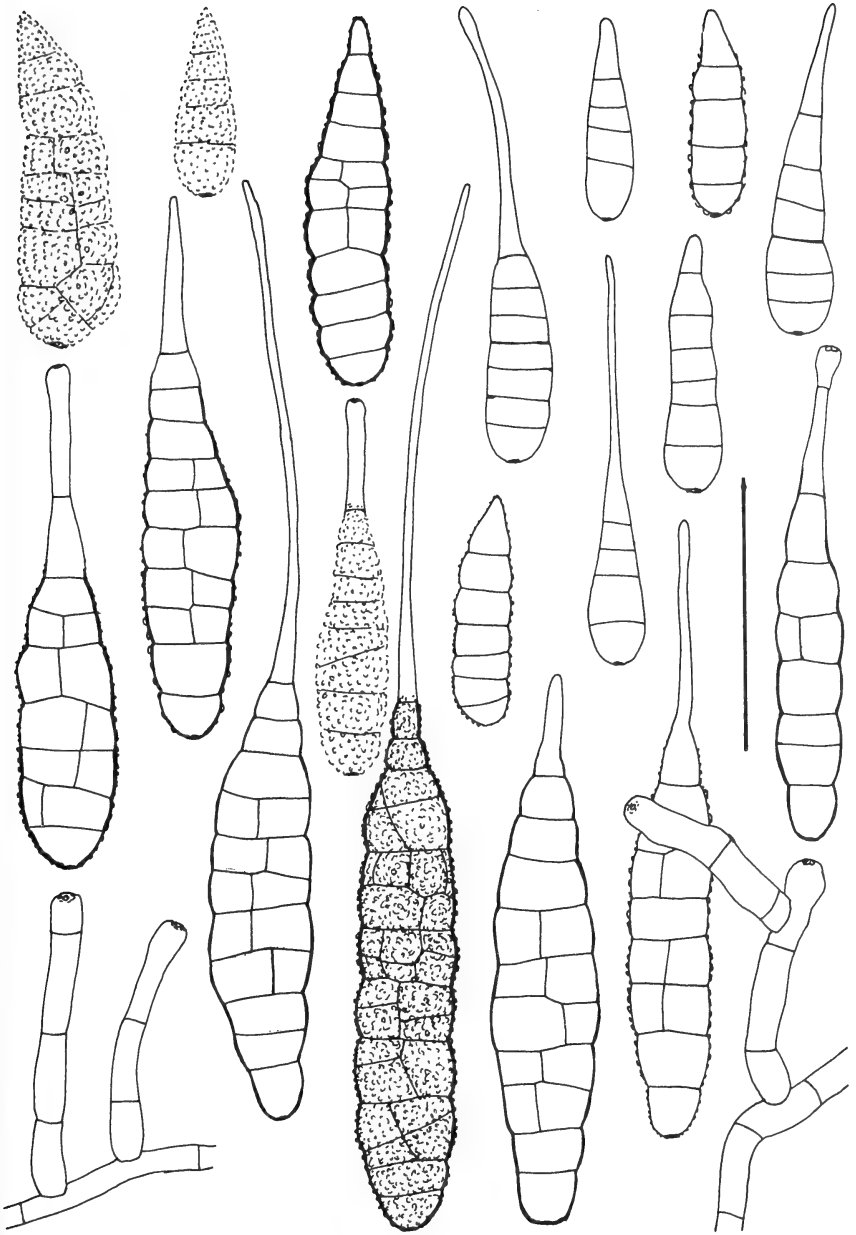


Fig. 55. Alternaria aragakii; conidia and conidiophores from Holotype. All conidium bodies conspicuously ornamented. Magn.: bar = 50 μm.

his own material was of a different species) has smooth-walled, filament-beaked conidia. These are somewhat similar to those of *A. aragakii* in shape, but the larger conidium bodies and dense ornamentation found in *A. aragakii* readily permit separation of the two species.

The literature on brown spot of passion fruit need not be concerned further with *A. tomato* as an incitant of a disease of *Passiflora* species unless new evidence is based on isolates identified correctly with the tomato pathogen. The results of the Aragaki experimental studies (loc. cit.) and the pathogenicity reports compiled by Rosenberg (1962) remain valid with reference to *A. aragakii*, which (as *A. tomato*) was reported to be pathogenic to *Passiflora edulis* and *P. edulis* var. *flavicarpa*.

57. **Alternaria hawaiiensis** E. Simmons

Conidia in the Hawaii isolates shared with me as representing *A. passiflorae* do not produce the multiple beaks characteristic of that species and thus are readily distinguishable from it. *A. passiflorae* does not occur among the Hawaii isolates known to me. Conidium ornamentation and beak characters of *A. hawaiiensis*, as detailed below, also differ from those of *A. aragakii*, so this third definable filament-beaked species from *Passiflora* also is described as novel.

Alternaria hawaiiensis E. Simmons, sp. nov. Fig. 56

Ex culturis in agaro V-8 descripta. Conidiophora simplicia vel ramosa, 110-145 x 6-8 µm, locis conidiogenis 1-4(-6), ramis 10-70 µm longis. Conidia initio ovoidea vel obturbinata, postea filamentose longirostrata, laevia, maturitate longe anguste ellipsoidea vel longe obclavoidea (corpus conidiorum), dilute fusca, usque ad 355 x 24 µm (corpore 80-130 x 18-24 µm + rostro 60-225 µm), 8-15 transverse et 0-5 longitudine septata. Conidia singularia vel sporulatio raro in catenis simplicibus conidiorum 2-3. Rostra filamentosa plerumque uniramosa. Habitatio typi Passiflora edulis Sims, Hawaii, U.S.A. Typus: partes ex EGS 29-020 (ex isol. M. Aragaki no. 75) desiccatae et in **BPI** *(holotypus) et pro isotypis saltem in IMI et* **NY** *conservandae.*

Conidiophores usually arise directly from the agar substrate surface; they are simple with a single terminal conidiogenous site, often becoming geniculate at 1-4 conidio-

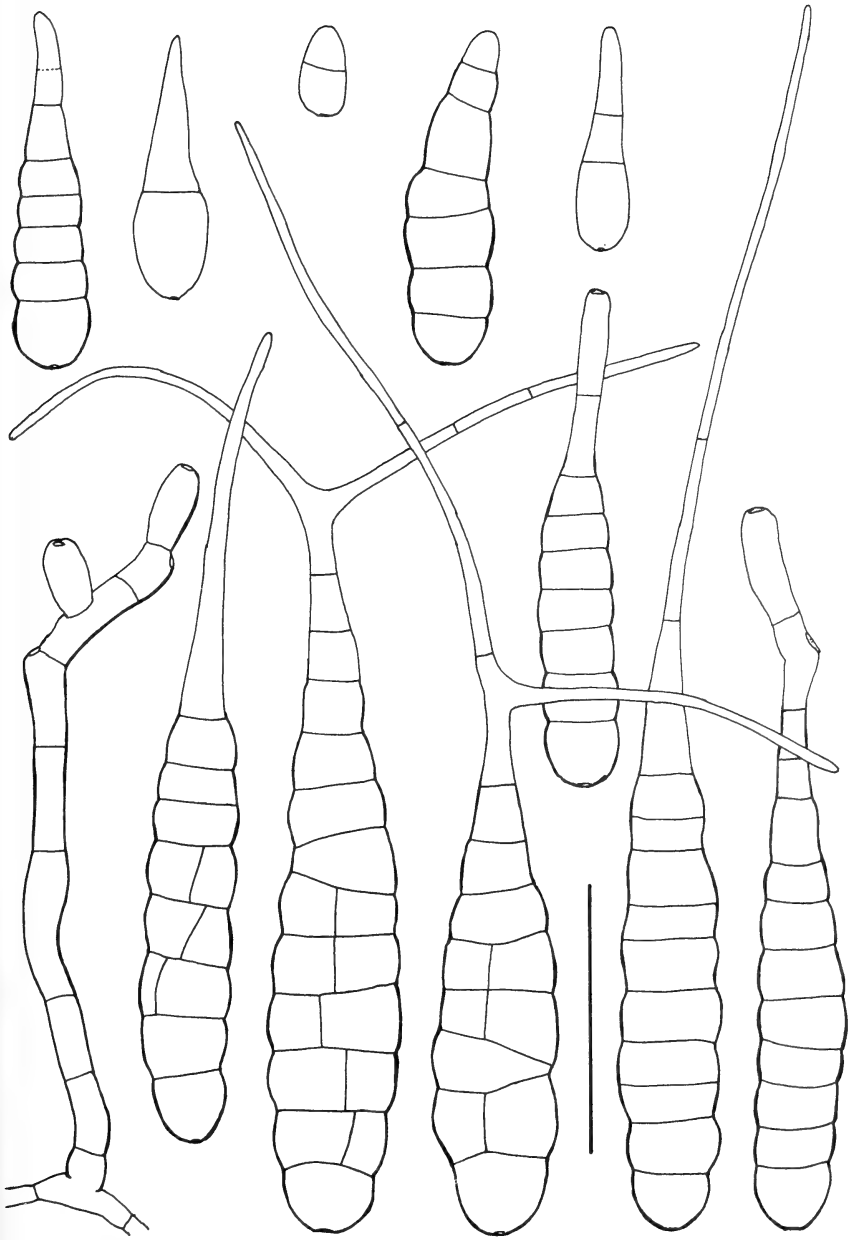


Fig. 56. Alternaria hawaiiensis; conidia and conidiophore from Holotype. Magn.: bar = 50 μm.

genous sites, 110-145 x 6-8 μm, or sometimes have 1-2 lateral branches 10-70 μm long; a well-developed conidiophore with subterminal branches often supports 4-6 conidia.

Juvenile conidia are ovoid, soon obturbinate, with one or two transverse septa soon after the spore body begins to expand; they rapidly develop a long tapering then narrowly filamentous beak as the conidium body enlarges and becomes long, narrowly ellipsoid or long obclavoid. The conidium population at 6 days on V-8 agar is dominated by narrowly ellipsoid spores with numerous well-defined transverse septa and a few less conspicuous longitudinal septa; this kind of conidium usually tapers into a long, straight filamentous beak, although uncommonly it produces an apical secondary conidiophore and generates a chain of 2-3 conidia. In the conidium population of a colony about 10-12 days old, the spore body of about half the largest conidia has widened and the long filamentous beak of many of these conidia has produced a lateral filamentous branch, usually near the apex of the spore body and commonly at a right angle to the parent beak.

The narrowly ellipsoid conidia commonly reach dimensions of 155-355 x 18-21 μm (spore body 90-130 plus beak 60-225 μm long) and at this stage have 9-15 transverse septa and lack longitudinal septa or have a single one in 2-3 of the transverse divisions. The spore body of the broader obclavate conidia reaches a size range of 80-130 x 22-24 μm and has 8-12 transverse septa and a single longitudinal septum in each of 3-5 of the transverse divisions; its primary beak often is 100-125 μm long and the lateral branch, when present, about 60 μm long. Conidia are dull tan in color with hyaline beak and darker transverse septa that define constrictions in the spore body; outer walls of the conidia appear to be smooth or, at most, minutely punctulate roughened over a few basal cells. No instance of multiple beaks or of more than one branch of a primary beak has been seen.

The spore body of conidia of *A. hawaiiensis* becomes considerably larger than that of *A. passiflorae* and at full development has a 1-branched beak apparatus quite different from the multiple, branching conidial beaks of *A. passiflorae*. The heavily ornamented conidium walls of *A. aragakii* and the absence of branched or multiple beaks provide the most striking characters useful in distinguishing the species from both *A. passiflorae* and *A. hawaiiensis*.

58. **Alternaria tropica** E. Simmons

Aragaki isolate no. 32 from passion fruit has remained without a name since its isolation in 1960; it is associated with his comment that its "Pathogenicity has been worked out." An isolate obtained by R. T. McMillan, Jr., in 1990 from *Passiflora* in Florida, reported as an incitant of passion fruit brown spot under the name *Alternaria passiflorae* (McMillan and Graves, 1991), is the same species as Aragaki's no. 32 from Hawaii. Of the two isolates, the one from Florida now sporulates more abundantly in culture, so it is used here for description and typification of an additional *Alternaria* that is morphologically distinct from all other isolates known to me from Hawaii and from typical *A. passiflorae*.

Alternaria tropica E. Simmons, sp. nov. Fig. 57

Ex culturis in agaro V-8 descripta. Conidiophora simplicia vel saepe ramosa, 50-200 x 5-8 µm, locis conidiogenis 1-4, ramis 10-90 x 6-7 µm. Conidia initio ovoidea vel late ellipsoidea, dein obclavoidea, denique longiellipsoidea (corpus conidiorum), sine rostro vel saepissime filamentose unirostrata, laevia vel aliquanto punctata, cinereofusca, usque ad 145-230 x 18-22 µm (corpore 100-115 + 45-115 µm), 11-16 transverse et 0-7 longitudinaliter septata. Conidia singularia vel sporulatio plerumque in catenis simplicibus conidiorum 2-3. Rostra numquam ramosa. Habitatio typi in fructu Passiflora edulis Sims, Florida, U.S.A. Typus: partes ex EGS 39-126 (ex isol. R. T. McMillan, Jr., in vere 1990) desiccatae et in ***BPI*** *(holotypus) et pro isotypis saltem in* ***IMI*** *et* ***NY*** *conservandae.*

Primary conidiophores arise directly from the surface of the agar substrate or, when surface mycelium is abundant, from aerial hyphae; they are simple in early stages of growth, about 50 x 5 µm, then tend to become longer (to about 200 x 8 µm) and quite commonly once or twice branched, with branches 10-90 x 6-7 µm and with one conidiogenous locus terminating each branch. The conidium body is ovoid or broadly ellipsoid when young, then becomes obclavoid and, at fullest development, long ellipsoid without a definable beak or, usually, with a single filamentous beak. The conidium outer wall sometimes appears smooth but usually is minutely punctulate over much of its surface. Conidia are a medium grey-brown in color; they reach fullest development in a size range of about 145-230 x 18-22 µm (spore body 100-115 + beak

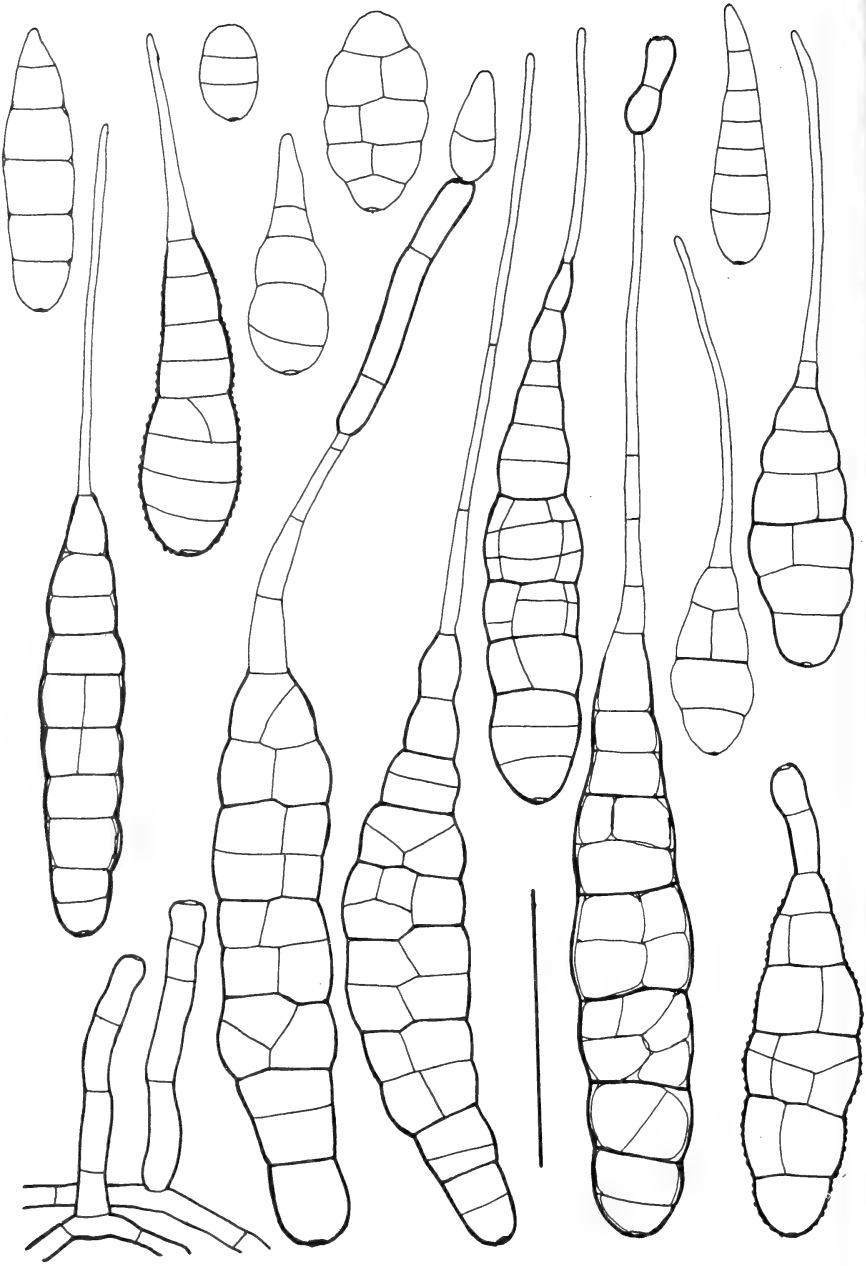


Fig. 57. Alternaria tropica; conidia and conidiophores from Holotype. Magn.: bar = 50 μm.

45-115), with 11-16 transverse and 1-2 longitudinal septa in up to 7 of the transverse divisions. Most conidia remain solitary, but some (perhaps less than 1% of the population) produce a secondary conidiophore at the tip of the filamentous beak, a secondary conidium, and rarely a tertiary conidium in a chain. The secondary conidiophore characteristically develops as a terminal enlargement of the narrow beak, rarely as a direct growth from the apical cell of an otherwise beakless conidium. No conidium with multiple or branched beaks has been seen in isolates of *A. tropica* from either Florida or Hawaii.

59. *Alternaria tenuissima* group, species 3 (cfr. Simmons 1990). Fig. 58

The only small-spored, long-chain representative among the *Passiflora* isolates from Hawaii (Aragaki no. 69; EGS 29-026) cannot be identified to species at present. It is included here because it is presumed to be the isolate reported as "*A. tenuis*" with pathogenicity to *Passiflora edulis, P. edulis* var. *flavicarpa, P. foetida,* and *P. quadrangularis* (Rosenberg 1962).

The sporulation pattern of this isolate has characteristics of both the *A. tenuissima* and the *A. alternata* groups of species. A plate-culture colony has a series of densely conidial growth rings concentric around the point of inoculation. Rings consisting of a dense turf of simple conidiophores and long unbranched chains of conidia arising directly from the surface of the agar substrate alternate with rings of loosely intertwined, erect or ascending hyphae bearing conidiophores with well-branched clumps of conidial chains.

Conidial chains that arise near the agar surface are similar to those of *A. tenuissima*: long chains of 10 or more conidia with somewhat narrow, elongate units predominating; in young colonies these chains are not branched, although moderately long branches of conidia may develop later (cfr. Simmons 1990, pp. 98-101).

Conidial chains that develop on the aerial hyphae are similar to those of *A. alternata*: chains of moderate length that branch repeatedly, forming loosely arborescent clusters of about 100 relatively small conidia (cfr. Simmons 1990, pp. 91-97; *A. alternata* (Fries : Fries) Keissler, not my lapsus . . . ("Nees" : Fries) Keissler).

The *A. tenuissima* sporulation characteristics of this isolate dominate the cultural picture. When the members of this group are sorted out taxonomically and nomenclaturally, however, this passion fruit isolate will appear as a marginal member of the group, in that the median transverse septum of its conidia is only slightly constricting and pigmented whereas that of typical *A. tenuissima* conidia often is darker and more constricting than are the other septa.

Young conidia of this isolate, as they develop on primary conidiophores near the agar surface, are ovoid to ellipsoid; they develop almost exclusively into elongate ovoid or ellipsoid units in unbranched chains of about 10 spores. Secondary conidiophores in the chains are either a scarcely differentiated cell or a 1-2-celled extension of the apex of a conidium. Only rarely does a secondary conidiophore become geniculate with more than one conidiogenous site (and thus initiate a branched chain) during the first 10 days of colony growth on V-8 agar; on PCA the sporulation pattern is the same for the first few days, but branching becomes evident, particularly in chains borne on aerial hyphae, within 10 days of growth.

Conidia reach an upper size range of about 35-50 x 10-13 μm with 6-8 transverse septa and a single longitudinal septum in 1-5 of the transverse segments of the spore. There is only a slight constriction of the spore body at the median transverse septum; septa are not strongly pigmented and thus appear to be poorly defined. Conidium color is a medium olivaceous brown; the conidium wall usually is smooth but it also frequently is well ornamented in an unpredictable pattern: partially or overall on juvenile or mature, small or large conidia. Conidiogenous pores and conidium basal pores are inconspicuous and usually lack a pigmented halo.

This species will be discussed eventually in the context of other members of the multitudinous *A. alternata* and *A. tenuissima* species groups, but only after similar 19th and 20th century species have been defined more precisely. It is my current practice to refrain from proposing novel species in these groups except when very distinct morphological and, perhaps, host restriction information suggests that a purpose useful to others might be served.

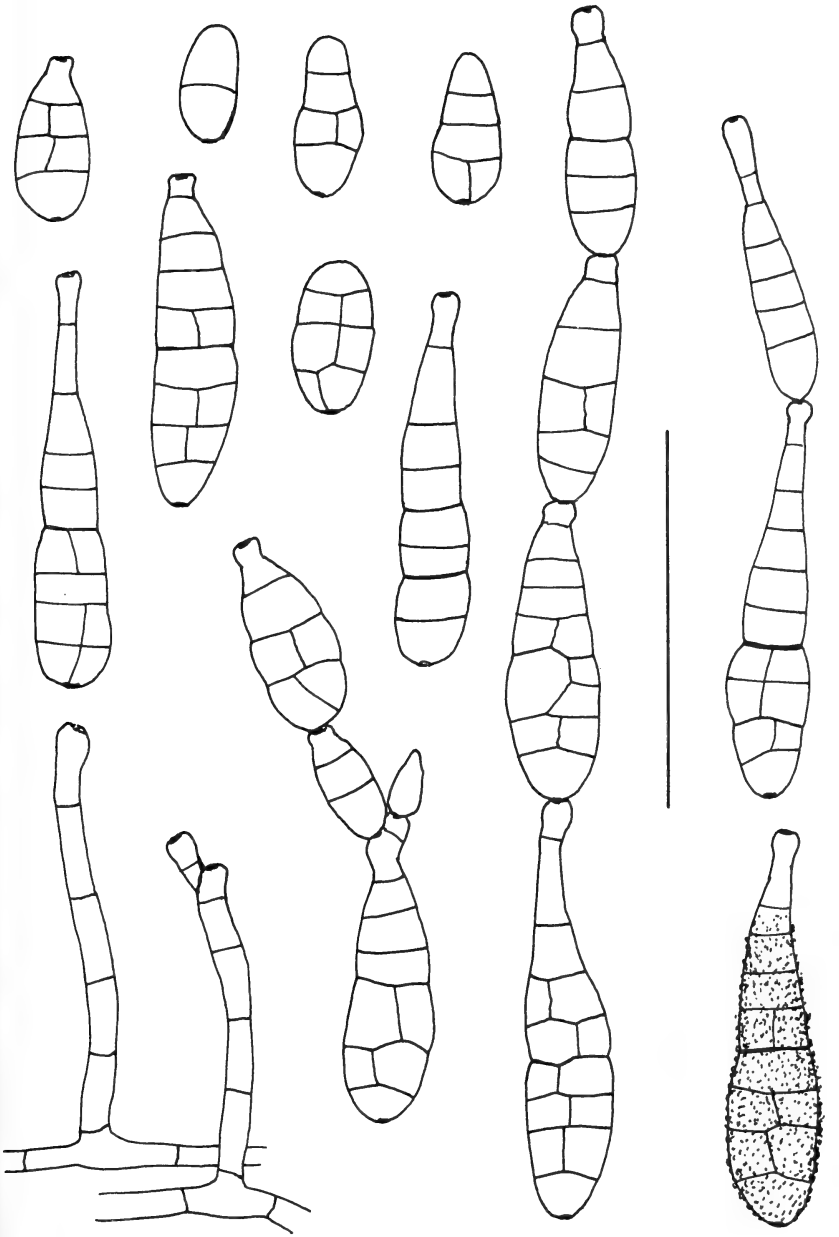


Fig. 58. Alternaria tenuissima group, species 3; conidia and conidiophores ex culture on V-8 agar. Magn.: bar = 50 μm.

Additional *Alternaria* on *Passiflora* Species

The National Fungus Collections (BPI) of the Agricultural Research Service, U. S. Department of Agriculture, currently lists four accessions of *Alternaria* on *Passiflora* substrates. One of these, mentioned earlier in section no. 54 of these remarks, is typical *A. passiflorae* on a leaf spot of *P. ligularis*, Hawaii (BPI US0445819, EGS 40-195). A second one, on fruit of a *Passiflora* species intercepted in a shipment from the Dominican Republic, is a small-spored *Alternaria* in a condition inadequate for species identification (BPI US0446473, EGS 40-196).

The two other BPI specimens are of two different *Alternaria* taxa. They are similar in only a generic sense to the other species on passion fruit already discussed above. In addition, they are unknown to me from any other source of field specimens or isolates, so they also are described as new species.

60. **Alternaria obclavoidea** E. Simmons, sp. nov. Fig. 59

Conidiophora recta vel flexa, simplicia vel ramosa et geniculate conidiogena, usque ad 50 x 4 µm. Conidia solitaria vel catenulata, ovoidea vel longe anguste obclavoidea, brunneola, laevia, maturitate 45-55 x 8-12 µm, erostrata, interdum pseudorostrata, 6-7 transverse et sparsim longitudine septata, ad aliquot transepta laevigate constricta. Habitatio typi in laesionibus fructus Passiflora sp. indet. Typus: BPI US0445818 (holotypus), ex Colombia ad Miami, Florida, U.S.A., 13/VII/1971, a E. W. Golsen interceptus (EGS 40-194).

Alternaria obclavoidea occurs in the type specimen as several distinct, tight, sporulating clumps of short conidiophores emerging through sunken lesions in the surface of a fruit. Conidiophores are simple or branched and geniculate, up to about 50 x 4 µm in size. Most of the conidia are solitary with a smoothly rounded or bluntly tapered apical cell. A few conidia in the specimen have produced an apical secondary conidiophore, indicating the ability of the taxon to be chain-forming. Conidia are ovoid at an early stage, gradually becoming long, narrowly obclavoid with a distinct distal taper into a bluntly triangular apical cell. Conidia are dilute medium tan, smooth, up to 45-55 x 8-12 µm, with 6-7 transverse septa and 1 longitudinal septum (rarely 2) in

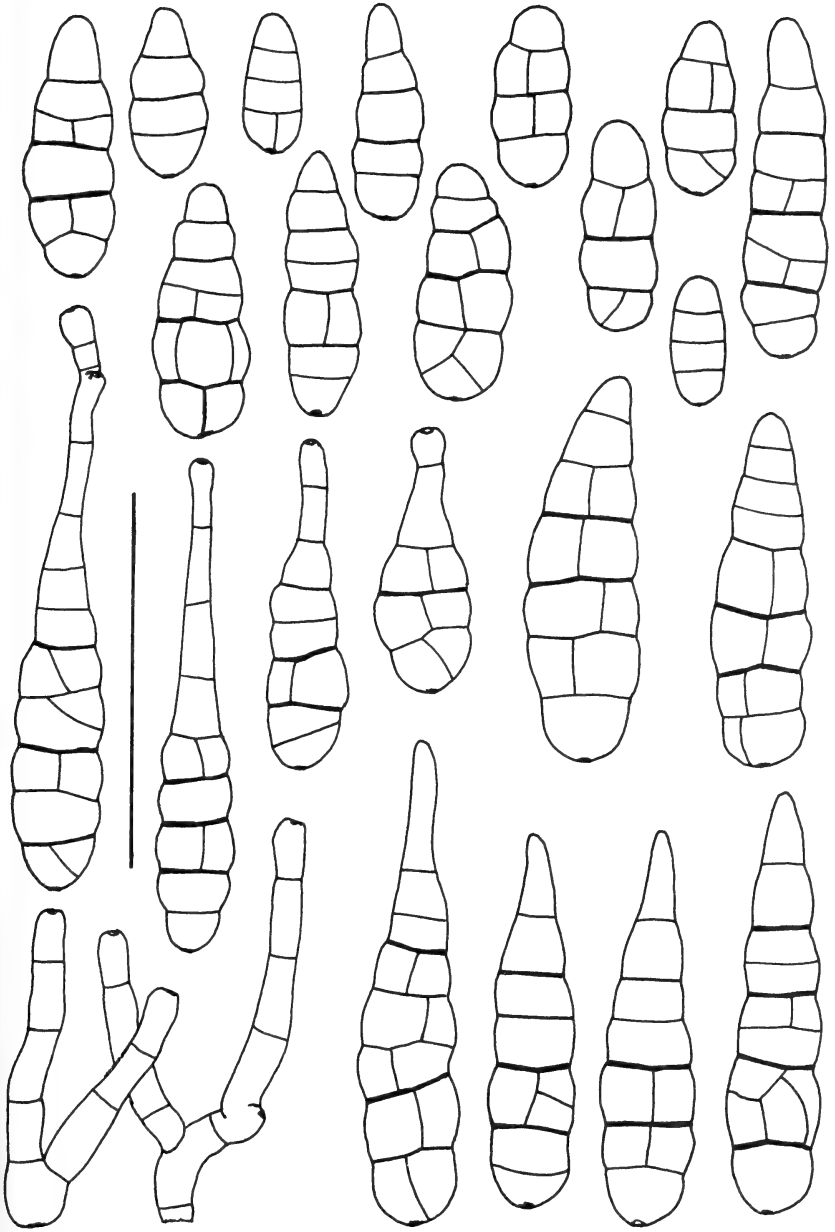


Fig. 59. Alternaria obclavoidea; conidia and conidiophores from Holotype. Magn.: bar = 50 μm.

1-4 of the transverse compartments. Conidia are distinctly but smoothly constricted at several of the transverse septa.

The characteristic upward tapering of solitary conidia brings to mind the largest conidia of *A. molesta* E. Simmons (1981), but any other resemblance between the two is superficial. *A. molesta* conidia are predominantly about half the size of those of *A. obclavoidea*, are strongly constricted at septa, and have outer walls so pale in color that transverse septa stand out in very strong contrast.

61. **Alternaria latifunda** E. Simmons, sp. nov. Fig. 60

Conidiophora recta vel flexa, simplicia vel geniculate conidiogena, usque ad 50-60 x 5-6 µm. Conidia solitaria vel catenulata, late ovoidea vel ovalia, brunneola, laevia, maturitate 40-50 x 18-30 µm, erostrata, interdum curte pseudorostrata, conspicue muriforme septata (septa transversa circa 6 et longitudinalia numerosa). Habitatio typi ad fructum cariosum Passiflora mollissima Bailey. Typus: BPI US0446474 (holotypus), Laupahoehoe, Hawaii, U.S.A., 24/II/1982, a C. S. Hodges lectus (EGS 40-197).

Alternaria latifunda occurs in the type specimen as an effuse turf of conidiophores and extremely abundant conidia over both obvious lesions and the surrounding smooth surfaces of a fruit. Conidia are broadly ovoid from the beginning, gradually enlarging and retaining the broadly ovoid form or sometimes becoming broadly ellipsoid or oval, pale yellowish tan aging to medium brown, smooth, up to 40-50 x 18-30 µm, beakless or sometimes with a short, apical pseudorostrum. Conidia become abundantly cellular as they reach their greatest dimensions. Septum formation is difficult to follow, but conidia eventually have three or four fairly strong and complete transverse septa, some secondary transepta, and, in optical section, as many as 3-4 series of longitudinal septa in the broadest of the transverse sections. Some of the largest conidia in the specimen have produced a short, apical secondary conidiophore, thus indicating the ability of this fungus to produce chains of conidia.

Alternaria latifunda has a group similarity to some *Alternaria* species whose erostrate, solitary conidia occasionally produce one or two secondary conidia; cfr. *A. cheiranthi* (Libert : Fr.) Bolle (Ellis 1971), *A. mouchaccae* E. Simmons and *A. triticina* Prasada & Prabhu (Simmons 1981).

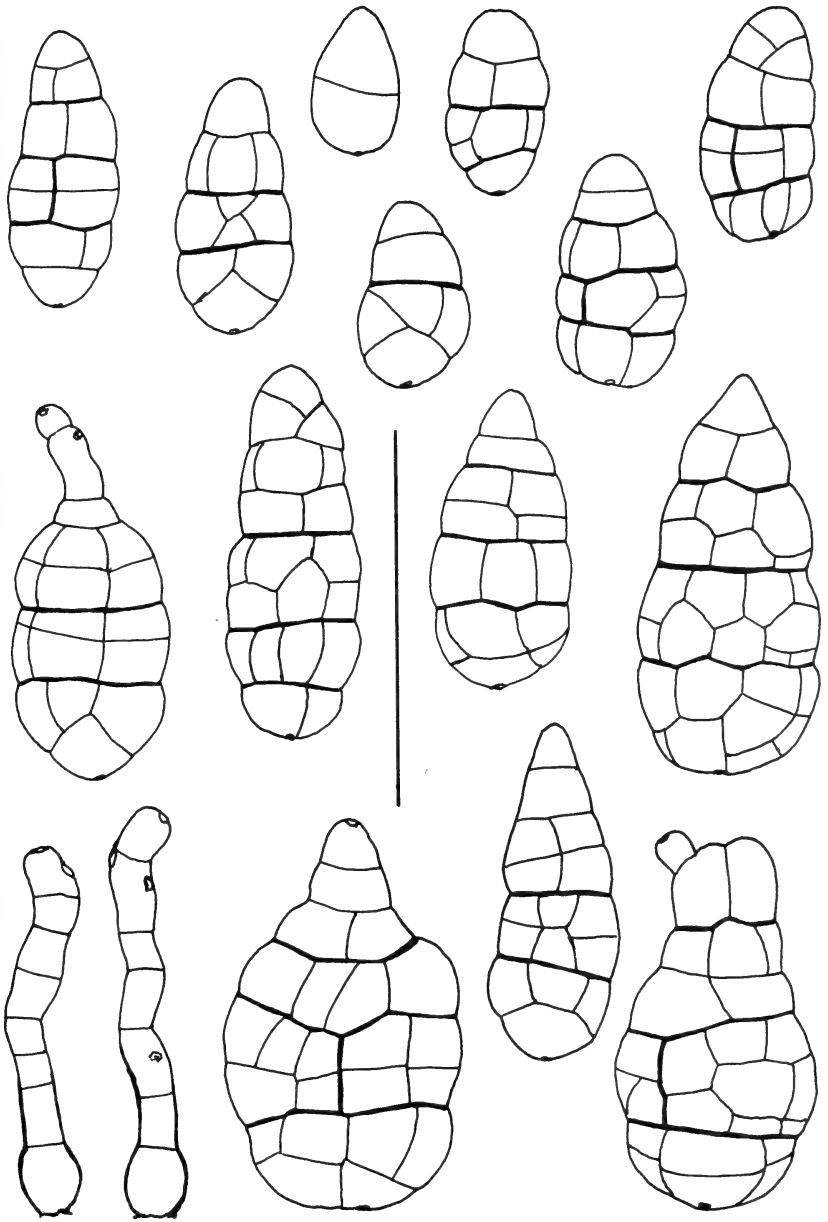


Fig. 60. Alternaria latifunda; conidia and conidiophores from Holotype. Magn.: bar = 50 μm.

- - o O o - -

Key to *Alternaria* Currently Known on *Passiflora***

A. Mature conidia comparatively long & long-beaked. . B/b
a. Mature conidia comparatively short, erostrate. . . F/f

B. Beaks broadly tapered. . . . . *A. aliena*
b. Beaks filamentous. . . . . C/c

C. Conidium wall smooth . . . . . D/d
c. Conidium wall ornamented . . . . . E/e

D. Beak multiple, branched in culture . *A. passiflorae*
d. Beak simple or, at most,
bifurcate in culture . . . . . *A. hawaiiensis*

E. Ornamentation dense, conspicuous;
secondary conidia rare . . . . . *A. aragakii*
e. Ornamentation inconspicuous;
secondary conidia common . . . . . *A. tropica*

F. Conidia broadly ovoid or ellipsoid . . *A. latifunda*
f. Conidia narrowly obclavate or ellipsoid. . . . G/g

G. Conidia with median constriction only. . *A. tenuissima*
g. Conidia with many smooth constrictions . *A. obclavoidea*

** The genus *Passiflora* comprises about 350 tropical or warm region species. Material of only six *Passiflora* species has served as substrates for the eight *Alternaria* species considered above. It would be irresponsible to suggest that a comprehensive *Alternaria/Passiflora* picture is represented here - or for any user to assume that every *Alternaria* subsequently found on a *Passiflora* plant can be forced into this key.

- - o O o - -

62. **"Alternaria passiflorae** Sawada"

This name, published posthumously as a "sp. nov." (Sawada 1959), is illegitimate both in its lack of a Latin diagnosis and in its status as a later homonym of *A. passiflorae* Simmonds (1938).

For the record, the fungus on the specimen originally cited for this name (TNS, on *Passiflora edulis*, Pref. Taipei, Taiwan, leg. K. Sawada, II-25, 1924; EGS 20-041) forms a dense black mat of *Alternaria* conidiophores and conidia over lesions of a fruit. The conidia are ovoid to broadly ellipsoid, at most 33.5-40 x 16-17.5 μm, muriformly septate, thick walled, rich red-brown, and erostrate but very commonly with short, apical, geniculate secondary conidiophores with 1-4 conidiogenous sites. Reconstruction of the sporulation pattern, on the basis of relative numbers of erostrate and pseudorostrate conidia, abundance of conidiogenous sites, and branching of primary conidiophores, suggests a species that produces dense clumps of conidia in short, branching chains over a thicket of primary conidiophores. The specimen has no characteristic helpful in distinguishing it from hundreds of other specimens from similar substrates worldwide, so it may eventually be identified correctly with one of the species of the *A. alternata* group or the *A. infectoria* group. There is no possibility that this Sawada specimen could be mistaken for any of the long-beaked species or for any of the other small-spored species discussed above.

ACKNOWLEDGEMENTS

Donors of culturally excellent and morphologically remarkable isolates of *Alternaria* from *Passiflora edulis* have been the guarantors that this essay on differentiation of the several species found on this host would be written: F. J. Morton and his New Zealand isolates of typical *A. passiflorae*; M. Aragaki and his morphologically extraordinarily diverse material from Hawaii; and R. T. McMillan, Jr., and his Florida isolate that provided a link to a species recognized earlier as distinct among material from Hawaii.

The value of specimens and cultures conserved at the C.A.B. International Mycological Institute, Kew; the National Fungus Collections, Beltsville; and the Royal Botanic Garden, Kew, and their availability to me over many years continue to be acknowledged with gratitude.

Dr. Mary E. Palm again has done me the kindness of reviewing a prepublication version of a paper critically without dampening my view that there are more lurking *Alternaria* species than we are accustomed to suspect.

LITERATURE CITED

Aragaki, M. 1961. Radiation and temperature interaction on the sporulation of *Alternaria tomato*. Phytopathology 51: 803-805.

Aragaki, M. 1962. Quality of radiation inhibitory to sporulation of *Alternaria tomato*. Phytopathology 52: 1227-1228.

Aragaki, M. 1964a. Some chemical requirements for the growth and sporulation of *Alternaria tomato*. Phytopathology 54: 562-564.

Aragaki, M. 1964b. Relation of radiation and temperature to the sporulation of *Alternaria tomato* and other fungi. Phytopathology 54: 565-569.

Brinkman, A. 1931. De roodneuzen-ziekte van *Phaseolus vulgaris* L., veroorzaakt door *Pleospora herbarum* (Pers.) Rbh. Proefschrift [Univ. Amsterdam]. N. V. Hollandia-Drukkerij, Baarn. 86 pp.

Ciferri, R. 1962. Schedae Mycologicae XXXV-XCVIII. Atti Ist. Bot. Univ. Pavia, ser. 5, 19: 85-139.

Cooke, M. C. 1883. New American Fungi. Grevillea 12: 22-33.

Elliott, J. A. 1917. Taxonomic characters of the genera *Alternaria* and *Macrosporium*. Amer. Journ. Bot. 4: 439-476.

Ellis, M. B. 1971. Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew. 608pp.

Ellis, M. B., and P. Holliday. 1970. *Alternaria passiflorae*. C.M.I. Descriptions of Pathogenic Fungi and Bacteria, no. 247. 2 pp.

Gambogi, P., G. Vannacci, and E. Triolo. 1975. Blight of *Dichondra repens* caused by *Alternaria dichondrae*. Trans. Brit. Mycol. Soc. 65: 322-328. Pl. 43.

Holmgren, P. K., N. H. Holmgren, and L. C. Barnett, editors. 1990. Index Herbariorum, Part I: The Herbaria of the World. 8th edition. 693 pp.

Jackson, C. R., and E. G. Simmons. 1968. Blight of *Richardia scabra* caused by *Alternaria multirostrata* sp. n. Phytopathology 58: 1139-1142.

Joly, P. 1964. Le Genre Alternaria. Encycl. Mycologique XXXIII. 250 pp.

Jones, L. R. 1896. P. 353, in Anonymous, Proceedings of the Botanical Club, A.A.A.S., Buffalo Meeting, August 25-29. 1896. Bull. Torrey Bot. Club 23: 350-362.

McMillan, R. T., Jr., and W. R. Graves. 1991. First report of passion fruit brown spot incited by *Alternaria passiflorae* in Florida. Pl. Disease 75: 319.

Raabe, A. 1938. Parasitische Pilze der Umgebung von Tübingen. Ein Beitrag zur Kryptogamenflora Südwestdeutschlands. Hedwigia 78: 1-106.

Rosenberg, M. M. 1962. Plant Pathology, pp. 74-77, in Report for the Biennium ending June 30, 1962. Hawaii Agric. Exp. Sta. 96 pp.

Sawada, K. 1959. Descriptive Catalogue of Taiwan (Formosan) Fungi. Part XI. Special Publ. no. 8, College of Agriculture, National Taiwan University. 268 pp.

Simmonds, J. H. 1930. Brown spot of the passion vine. Queensland Agric. Journ. 34: 564.

Simmonds, J. H. 1936. Diseases of the passion vine. Queensland Agric. Journ. 45: 322-330.

Simmonds, J. H. 1938. *Alternaria Passiflorae* n. sp. the causal organism of brown spot of the passion vine. Proc. Roy. Soc. Queensland 49: 150-151. Pl. VI.

Simmons, E. G. 1981. *Alternaria* themes and variations [1-6]. Mycotaxon 13: 16-34.

Simmons, E. G. 1990. *Alternaria* themes and variations (27-53). Mycotaxon 37: 79-119.

Simmons, E. G. 1992. *Alternaria* taxonomy: current status, viewpoint, challenge; pp. 1-35, in Cheĭkowski, J., and A. Visconti (editors), *Alternaria*: Biology, Plant Diseases and Metabolites. Elsevier, Amsterdam. 573 pp.

Weber, G. F. 1934. Studies on nailhead spot of tomatoes. Phytopathology 24: 836.

Weber, G. F. 1939. Nailhead spot of tomato caused by *Alternaria tomato* (Cke.) N. Comb. Univ. Florida Agric. Exp. Sta. Bull. 332. 54 pp.

MYCOTAXON

Volume XLVI, pp. 201-210 January-March 1993

MELIOLACEAE OF SOUTHERN INDIA-XII

V.B. Hosagoudar

Botanical Survey of India, Southern Circle, Coimbatore 641003, India

B. Rajeshwari Dayal

Applied Botany Division, Mangalore University, Mangalgangotri 574199, India

and

R.D. Goos

Department of Botany, University of Rhode Island, Kingston, RI 02881, U.S.A.

ABSTRACT

This paper gives an account of thirteen species of meliolaceous fungi collected from Madikeri and Sampaje in Kodagu district and Kaiga in Uttara Kannada district of Karnataka. Of these, Meliola kingiodendri is a new species; Asteridiella sapotacearum Hansf., Meliola canarii Sydow, M. mayapeae Stev. and M. pterocarpi Yates are new records for India, while Amazonia syzygii Hosagoudar, Meliola bicornis Wint., M. indica Sydow, M. holigarnae Stev., M. machili Yamam., M. malabarensis Hansf., M. mangiferae Earle and M. tamarindi Sydow are reported for the first time from Karnataka.

Key words: Meliolaceae, Amazonia, Asteridiella, Meliola, Karnataka.

The first report of meliolaceous fungi from India, Meliola densa Cooke and M. zigzag Berk. & Curt., was from Belgaum in Karnataka (Cooke, 1880, 1884). Based on M.J. Thirumalachar's collections from Karnataka, Hansford and Thirumalachar (1948) described a number of meliolaceous fungi. Hosagoudar (1988) and Hosagoudar and Manian (1989) described two more taxa of these fungi from Karnataka. Though the Western Ghats of Karnataka are rich in these fungi, only about forty taxa have been recorded so far from this region.

This report is concerned with meliolaceous fungi collected from the Western Ghats, mainly from the forest nurseries in Madikeri and Sampaje, Kodagu district, and two specimens collected from the forests in Kaiga, Uttara Kannada district, Karnataka.

1. **Amazonia syzygii** Hosagoudar in Hosagoudar & Goos, Mycotaxon 36: 236, 1989.

On leaves of seedlings of Syzygium sp. (Myrtaceae), Sampaje forest nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal HCIO 30841.

This species was described by Hosagoudar from the forests of Idukki, Kerala (Hosagoudar & Goos, 1989).

2. **Asteridiella sapotacearum** Hansf., Sydowia 10: 50, 1957. Irene sapotacearum Hansf., Sydowia 9: 7, 1955. (Fig. 1)

Colonies amphigenous, dense, crustose to velvety, up to 3 mm in diam., rarely confluent. Hyphae substraight, branching alternate, opposite or irregular at acute to wide angles, loosely reticulate, cells 18-34 x 6-9.5 um. Capitate hyphopodia alternate, antrorse to subantrorse, 18-25 um long; stalk cells cylindrical to cuneate, 6-9.5 um long; head cells ovate, entire, 12-15.5 x 9-12.5 um. Phialides mixed with capitate hyphopodia, alternate to opposite, conoid to ampulliform, 15-25 x 9-12.5 um. Perithecia scattered, globose, up to 155 um; perithecial wall cells conoid, straight to curved, acute to obtuse at the apex, 10-15 um long; ascospores obovoid, 4-septate, slightly constricted at the septa, 34-40.5 x 15-18 um.

On leaves of seedlings of Madhuca longifolia (L.) Macbr. var. latifolia (Roxb.) A. Chev. (Sapotaceae), Sampaje forest nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal HCIO 30829.

This collection slightly differs from the type in having amphigenous, dense, crustose to velvety colonies. This species was first recorded on an undetermined host of the family Sapotaceae from Brazil and is reported here for the first time from India (Bilgrami et. al. 1979, 1981).

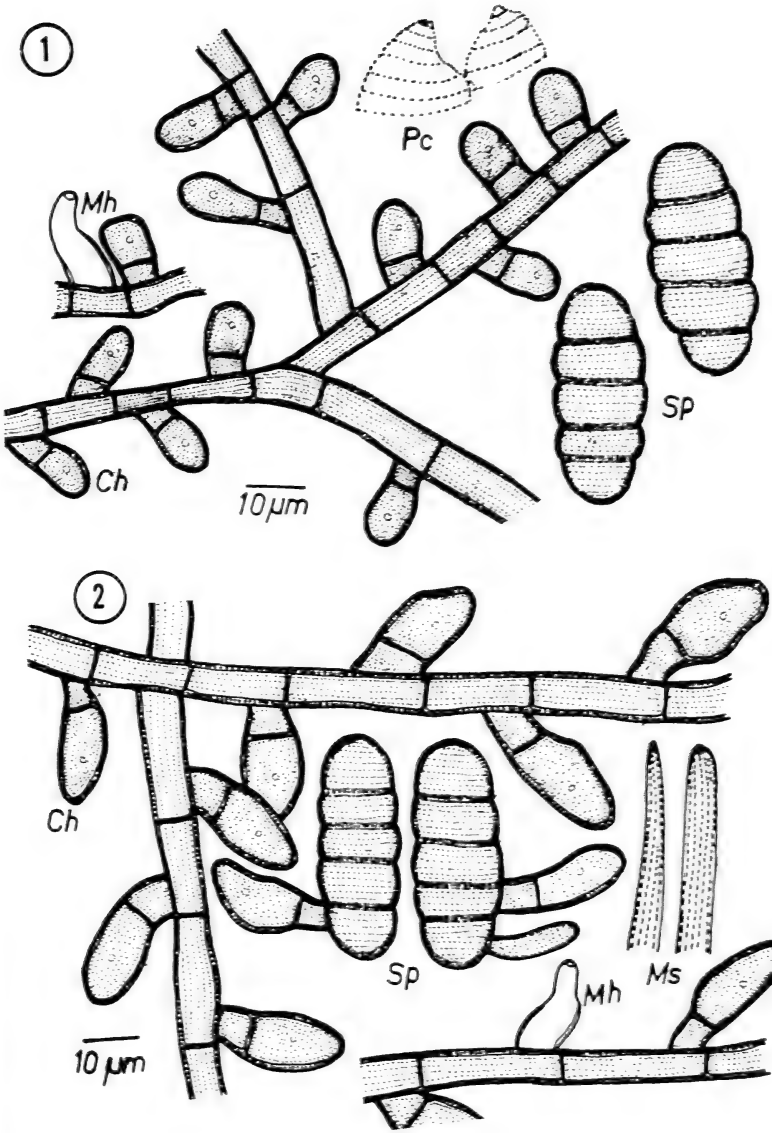


Fig. 1. Asteridiella sapotacearum Hansf.

Fig. 2. Meliola canarii Sydow.

3. **Meliola bicornis** Wint., Hedwigia 25: 99, 1886.

On leaves of seedlings of Acacia sinuata (Lour.) Merr. (Mimosaceae), Sampaje forest nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal HCIO 30832.

Careful examination of the collection revealed very few repent setae around perithecia and only one mycelial seta among several colonies. The possibility of missing these setae and arriving at a wrong determination is high. This is the first report of this species on this host.

4. **Meliola canarii** Sydow, Ann. Mycol. 12: 550, 1914.

Meliola nigro-rufescens Sacc., Att. Accad. Ven.-Trent.-Istr. 10: 60, 1914. (Fig. 2)

Colonies epiphyllous, thin to thinly velvety, up to 5 mm in diameter, rarely confluent. Hyphae straight to flexuous, branching opposite at wide angles, loosely reticulate, cells 34-50 x 6-8 um. Capitate hyphopodia alternate, less than 1% opposite, antrorse, 30-40.5 um long; stalk cells cuneate, 6-12.5 um long; head cells ovate, tapered and broadly rounded but rarely truncate at the apex, entire, 24-28 x 6-8 um. Mycelial setae thinly scattered all over the colonies, simple, straight, acute to obtuse at the tip, up to 1050 um long. Perithecia scattered, globose, up to 140 um; ascospores obovoid to cylindrical, 4-septate, slightly constricted at the septa, 43-46.5 x 18-20 um.

On leaves of seedlings of Canarium strictum Roxb. (Burseraceae), Sampaje forest nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal HCIO 30838.

This collection differs slightly from the type of the species in having only epiphyllous colonies, larger hyphal cells, larger and less than 1% opposite capitate hyphopodia and mycelial setae (Hansford, 1961).

This species was reported on Canarium spp. and Bursera serrata from Philippines, Malaya and Pakistan and is reported here for the first time from India on a hitherto unrecorded host species (Bilgrami et. al. 1979, 1981).

5. **Meliola holigarnae** Stev., Ann. Mycol. 26: 260, 1928.

On leaves of Holigarna grahamii (Wight) Kurz (Anacardiaceae), Kaiga forest, Kaiga, Uttara Kannada, Karnataka, Dec. 6, 1991. S. Shetty. HCIO 30831.

6. **Meliola indica** Sydow in Sydow & Butler, Ann. Mycol. 9: 382, 1911.

Meliola barringtoniae Yates, Philipp. J. Sci. 12: 363, 1917.

On leaves of Careya arborea Roxb. (Barringtoniaceae), Kaiga, Uttara Kannada, March 19, 1992, S. Shetty. HCIO 30837.

The southern Indian collections from Western Ghats show overlapping characters between Meliola indica Sydow and M. indica Sydow var. careyae Stev. However, in the former taxon phialides are mixed with capitate hyphopodia, while in the latter, they are borne on a separate mycelial branch.

7. **Meliola kingiodendri** sp. nov.
(Fig. 3)

Plagulae hypophyllae, raro amphigenae, densae, ad 5 mm diam., raro confluentes. Hyphae rectae, raro anfractae, ramifications plerumque oppositis in angulis acutis vel latis, laxe reticulatae, cellulae 27-35.5 x 6-9.5 um. Hyphopodia capitata opposita, raro solitaria, antrorsa, reflexa vel patentia, 15-18 um longa; cellula basali cylindracea vel cuneata, 3-6.5 um longa; cellula apicali piriformia, conoidea vel rotundata ad apicem, recta, curvula vel recurva, integra, 12-15.5 x 6-9.5 um. Phialides illis capitatis commixtae, ampullaceae, rectae vel curvulae ad apicem, 18-25 x 9-12.5 um. Setae myceliales aequaliter dispersae in coloniis, simplices, rectae, obtusae vel dentatae ad apicem, usque ad 575 um longae. Perithecia dispersa, globosa, usque ad 248 um diam.; cellulae peritheciales ad apicem rotundae et protrudentia; ascosporae 4-septatae, ellipsoideae, constrictae ad septos, 37-40.5 x 18-22 um.

Colonies hypophyllous, rarely amphigenous, dense, up to 5 mm in diam., rarely confluent. Hyphae straight, very rarely crooked, branching mostly opposite at acute to wide angles, loosely reticulate, cells 27-35.5 x 6-9.5 um. Capitate hyphopodia opposite, rarely solitary, antrorse, reflexed to spreading, 15-18 um long; stalk cells cylindrical to cuneate, 3-6.5 um long; head cells pyriform, conoid with rounded ends, straight, curved to recurved, entire, 12-15.5 x 6-9.5 um. Phialides mixed with capitate hyphopodia, ampulliform, straight to curved at the apex, 18-25 x 9-12.5 um. Mycelial setae evenly scattered on the colonies, simple, straight, obtuse to dentate at the tip, up to 575 um long. Perithecia scattered, globose, up to 248 um in diam., perithecial cells projected and rounded at the apex; ascospores 4-septate, ellipsoidal, constricted at the septa, 37-40.5 x 18-22 um.

Holotype: On leaves of seedlings of Kingiodendron pinnatum (Roxb.) Harms (Caesalpiniaceae), Sampaje forest

nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal. HCIO 30836.

This new species is close to Meliola aethiops Sacc. and M. caesalpiniicola Deight. reported on Cassia spp. from Singapore, Sumatra, Java, and Sierra Leone, and on Caesalpinia nuga from Philippines, respectively, in having only opposite capitate hyphopodia (Hansford, 1961). However, the new species differs from M. aethiops in having loosely reticulate hyphae, conoid head cells of the capitate hyphopodia, larger perithecia, smaller ascospores and larger but simple to dentate mycelial setae. It differs from M. caesalpiniicola in having conoid head cells of the capitate hyphopodia and straight, simple to dentate mycelial setae.

8. **Meliola machili** Yamam., Trans. Nat. Hist. Soc. Formosa 31: 23, 1941.

On leaves of seedlings of Persea macrantha (Nees) Kosterm. (Lauraceae), Sampaje forest nursery, Sampaje, Kodagu district, Karnataka, Dec. 22, 1991. B.R. Dayal HCIO 30834.

9. **Meliola malabarensis** Hansf., Proc. Linn. Soc. London 157: 187, 1946.

On leaves of Olea dioica Roxb. (Oleaceae), Sampaje, Kodagu, Feb. 15, 1992, B.R. Dayal HCIO 30839.

10. **Meliola mangiferae** Earle, Bull. New York Bot. Gard. 3: 307, 1905.

On leaves of seedlings of Mangifera indica L. (Anacardiaceae), Madikeri forest nursery, Kodagu district, Karnataka, Dec. 21, 1991, B.R. Dayal. HCIO 30833.

11. **Meliola mayapeae** Stev., Illinois Biol. Monograph 2: 48, 1916. (Fig. 4)

Colonies epiphyllous, dense, up to 2 mm in diam., often confluent. Hyphae straight to flexuous, branching opposite at wide angles, closely reticulate, cells 15-34 x 5-7 um. Capitate hyphopodia alternate, antrorse, reflexed to spreading, mostly straight, 15-18.5 um long; stalk cells cylindrical to cuneate, 3-6.5 um long; head cells ovate to globose, entire, 12-13 x 9-11 um. Mucronate hyphopodia mixed with capitate hyphopodia, opposite to alternate, ampulliform, 15-18.5 x 7-9.5 um. Mycelial setae grouped around perithecia, straight, simple, acute to obtuse, up to 235 um long. Perithecia loosely grouped, up to 186 um in diam.; ascospores obovoidal, 4-septate, slightly constricted at the septa, 37-40.5 x 15-18.5 um.

On leaves of seedlings of Ligustrum perrottetii DC

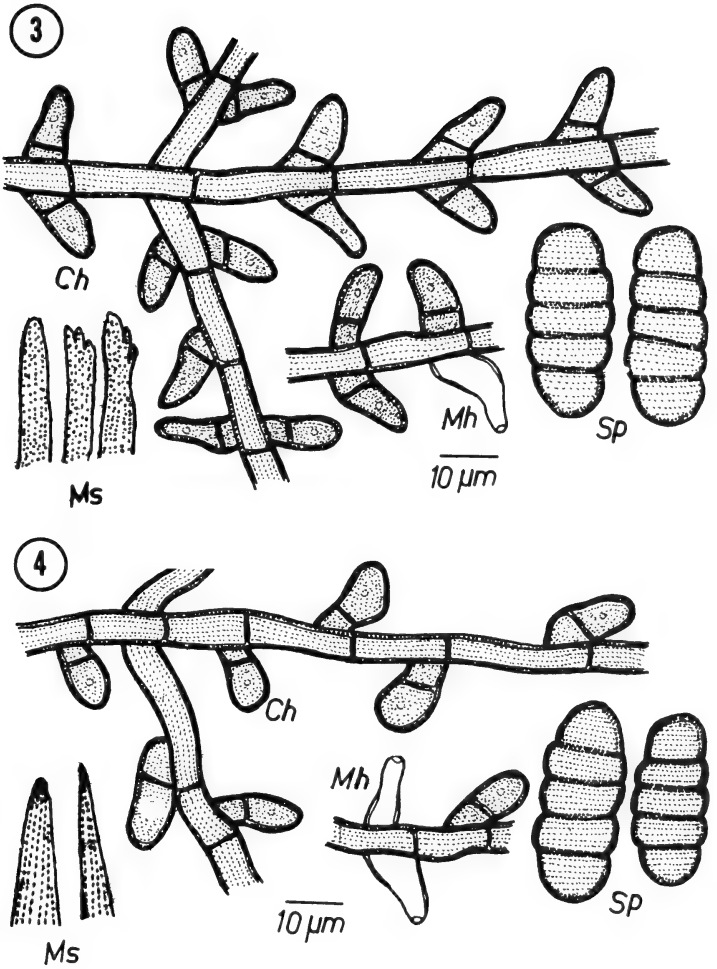


Fig. 3. Meliola kingiodendri Hosagoudar

Fig. 4. Meliola mayapeae Stev.

(Oleaceae), Madikeri forest nursery, Kodagu, Dec. 21, 1991, B.R. Dayal HCIO 30830.

This species was recorded on Mayapea dominguensis from Puerto Rico (Stevens, 1916), and is reported here for the first time from India on a hitherto unreported host genus.

12. **Meliola pterocarpi** Yates, Philipp. J. Sci. 13: 235, 1918. (Fig. 5)

Colonies amphigenous, mostly epiphyllous, dense, up to 3 mm in diam., rarely confluent. Hyphae substraight to flexuous, branching opposite at acute angles, loosely to closely reticulate, cells 18-31 x 6-9.5 um. Capitate hyphopodia alternate, straight to curved, antrorse to reflexed, 15-18 um long; stalk cells cylindrical to cuneate, 6-9.5 um; head cells globose to obovoid, entire to rarely slightly angulose, 12-16 x 12-15.5 um. Phialides mixed with capitate hyphopodia, alternate to opposite, ampulliform, 15-22 x 7-9.5 um. Mycelial setae mostly grouped around perithecia, simple, straight, obtuse at the apex, up to 300 um long. Perithecia scattered, globose, up to 168 um in diam.; ascospores obovoidal, 4-septate, slightly constricted at the septa, 40-43.5 x 15-18.5 um.

On leaves of seedlings of Pterocarpus marsupium Roxb. (Fabaceae), Sampaje forest nursery, Sampaje, Kodagu, Dec. 22, 1991, B.R. Dayal HCIO 30835.

The Indian collection differs from the description in having slightly larger capitate hyphopodia, larger head cells and larger mycelial setae. This species was reported on Pterocarpus indicus from Sumatra and Philippine islands. This is the first report of the fungus from India (Bilgrami et al. 1978, 1981)

13. **Meliola tamarindi** Sydow, Ann. Mycol. 10: 79, 1912.
On leaves of seedlings of Tamarindus indica L. (Caesalpiniaceae), Sampaje forest nursery. Sampaje, Kodagu district, Karnataka, Dec. 22, 1991, B.R. Dayal. HCIO 30840.

This species was reported from Kerala by Hosagoudar & Goos (1990).

ACKNOWLEDGEMENTS

The authors are grateful to Prof. K.M. Kaveriappa and Mr. B.V. Shetty, Emeritus Scientist (BSI), Mangalore University for their valuable suggestions and to Mr. Shridhar Shetty for providing two of his collections. Two of us (VBH & BRD) express our gratitude to Scientists' Pool Scheme, C S I R, New Delhi and Nuclear Power Corporation, Govt. of India, respectively for financial assistance. We are grateful to Dr. F.A. Uecker for his pre-publication review of the manuscript.

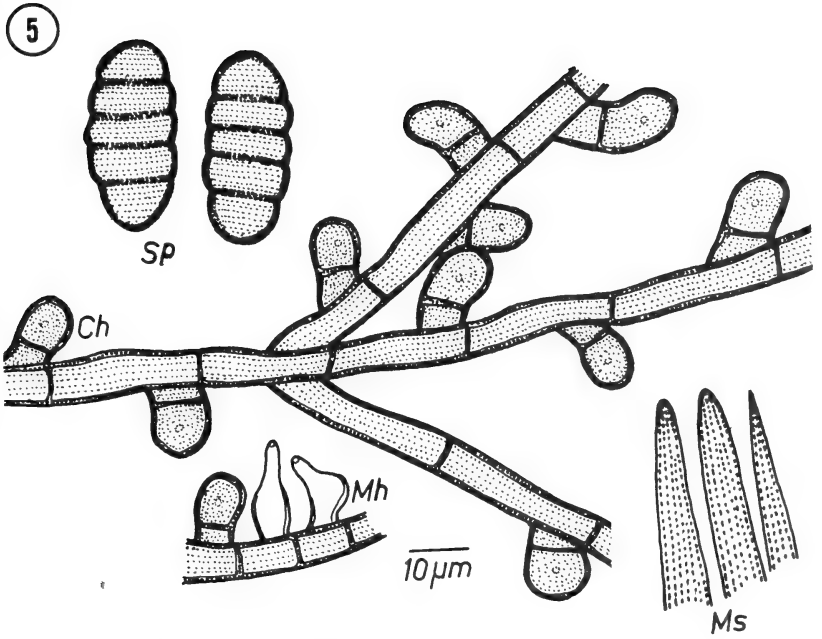


Fig. 5. Meliola pterocarpi Yates

REFERENCES

Bilgrami, K.S., Jamaluddin and M.A. Rizwi. 1979. Fungi of India. Part-1. List and references. Today & Tomorrow's Printers & Publishers, New Delhi.

Bilgrami, K.S., Jamaluddin and M.A. Rizwi. 1981. Fungi of India. Part-11. Today & Tomorrow's Printers & Publishers, New Delhi.

Cooke, M.C. 1880. Fungi of India. Grevillea 8: 96.

Cooke, M.C. 1884. Some exotic fungi. Ibid. 12: 85.

Hansford, C.G. 1961. The Meliolineae. A Monograph. Sydowia Beih. 2: 1-806.

Hansford, C.G. and M.J. Thirumalachar. 1948. Fungi of South India. Farlowia 3: 285-314.

Hosagoudar, V.B. 1988. Meliolaceae of South India-V. Nova Hedwigia 47: 535-542.

Hosagoudar, V.B. and R.D. Goos. 1989. Meliolaceous fungi from the state of Kerala, India-I. Mycotaxon 36: 221-247.

Hosagoudar, V.B. and R.D. Goos. 1990. Meliolaceous fungi from the State of Kerala, India-II. Meliola. Mycotaxon 37: 217-272.

Hosagoudar, V.B. and S. Manian. 1989. A new species of Amazonia Theiss. from Karnataka. J. Econ. Tax. Bot. 13: 45-46

MYCOTAXON

Volume XLVI, pp. 211-215 January-March 1993

UMBILICARIA DENDROPHORA

Geir Hestmark

Department of Biology, Division of Botany
University of Oslo, Box 1045, Blindern, 0316 Oslo, Norway

Abstract

The combination *Umbilicaria dendrophora* (Poelt) Hestmark is proposed, and the lichen taxon described and discussed.

Umbilicaria dendrophora (Poelt) Hestmark comb. nov.

Umbilicaria vellea var. *dendrophora* Poelt, in Hasenhüttl & Poelt (1978): Ber. Deutsch. Bot. Ges. Bd. 91: 284. - Type: Sweden. Torne Lappmark, Umgebung von Abisko: Steilflächen eines schwermetallhaltigen Gesteins im Laktavagge, um 1000 m 16.7.1967. leg. J. Poelt (holotype: GZU; isotype: UPS).

Thallus: up to 8 cm in diameter, more commonly 2-4 cm; orbicular to more irregular in outline, mono- or polyphyllous, usually fairly rigid. Margins revolute, entire or somewhat lacerate. Upper surface dull, smooth to pruinose, light to medium grey. Umbo obscure to moderately elevated, occasionally corrugated. Lower side dull, smooth, light pinkish buff; covered with moderately to richly branched, terete, up to 3 mm long rhizinomorphs which often produce multi-septate thalloconidia at their tips. Rhizinomorphs commonly absent around the umbilicus. Occasionally the rhizinomorphs develop small thalli - thallyles - at their tips.

Upper cortex three-layered: 1) epinecral layer; up to ca. 50 µm thick; amorphoid, hyaline, discontinuous, eroded; 2) brown pigmented layer; up to 15 µm thick consisting of agglutinated hyphae of variable wall-thickness with rounded lumina; 3) hyaline layer + algal layer; up to 300 µm thick; consisting of agglutinated, hyphae with rounded lumina and clusters of unicellular alga. Medulla up to 350 µm thick; composed of loosely interwoven, mesodermate, mainly horisontally orientated hyphae. Lower cortex two-layered: 1) hyaline layer; up to ca. 130 µm thick; consisting of agglutinated hyphae with rounded lumina; 2) necral

outer layer; up to 50 µm thick; amorphous, yellow to brown, discontinuous, eroded.

Apothecia: rare; substipitate to stipitate, up to 2 mm in diam., black, disc with multi-gyrose pattern. Excipulum proprium present. Epithecium brown to black, agglutinated, up to 24 µm. Hymenium hyaline, up to 50 µm thick. Paraphyses usually simple, septate, slender, up to 2 µm thick. Subhymenium hyaline, up to 65 µm thick. Hypothecium brown pigmented, up to 110 µm thick. Asci broadly clavate, 40-48 x 10-13 µm; spores 8 per ascus, simple or 1-septate, hyaline to slightly brown, spherical to ellipsoid: 5-10 x 5-8 µm.

Spermogonia: common, broadly pyriform, up to ca. 300 µm deep, with hyaline to pigmented wall. Spermatiophores moderately branched. Spermatia 2-3 x 0.5 µm, usually very abundant.

Thalloconidia: common; multi-septate, 4- to 20-(60-)cellular, occasionally non, 1- or 2-septate; spherical outline to somewhat angular, or more irregularly aggregated; 22.7 ± s.d.=10.8 (min. 8.0, max. 73.0) x 18.2 ± s.d.=7.5 (min. 6.5, max. 50.0) µm (n=150); brown to dark brown, verging upon black; surface delicately roughened to rugged or granulate over the bullate exterior; wall three-layered, (0.3) - 2.0 - (3.6) µm thick. (cf. Hestmark 1990, Fig. 8).

Chemistry: no lichen substances detected with TLC, standard methods (Menlove 1974). Traces of norstictic acid reported by Seaward et al.(1983).

Ecology: sub-alpine to low-alpine; saxicolous; on steeply inclined, exposed, fairly dry rock faces and boulders; substrate: metamorphic sedimentary rocks (hornfelses, phyllites, mica schists etc), sometimes slightly calcareous. All known localities appear to have a substrate with a high concentration of iron-oxides (cf. also Seaward et al. 1983).

Known geographical distribution: Europe (Andorra, Norway, Poland, Sweden).

Discussion

The taxon was originally described by Poelt (in Hasenhüttl & Poelt 1978) as a variety of *Umbilicaria vellea* (L.) Ach. em Frey. The Norwegian lichenologist Bernt Lynge, possibly the first to collect specimens of the taxon (in Troms, Norway in 1910), also labelled it - hesitantly - "Umbilicaria (vellea)" (Lynge's collection is cited in the specimen list below).

Although the taxon on a superficial examination of its morphology may resemble *U. vellea* (this is attested by the number of misidentified specimens for instance in O), the *anatomy* of the taxon is quite different from *U. vellea*. The latter species has a continuous algal layer overlaying a compactly agglutinated medullar tissue. The medulla changes gradually into the lower cortex. *U. dendrophora*, in contrast, has a discontinuous algal layer and a loosely woven medulla. The medulla changes abruptly into a compact, scleroplectenchymatous

lower cortex. *U. dendrophora* lacks the peg-like rhizinomorphs of *U. vellea*. The the secondary substance chemistry is also different: *U. vellea* always has gyrophoric acid and lecanoric acid, *U. dendrophora* has neither of these. The thalloconidia of *U. vellea* are on average larger than those of *U. dendrophora* (Hestmark 1990). Thus the taxon clearly does not belong to the 'vellea group'.

Topham et al. (1982) and Seaward et al. (1983) interpreted the taxon as *Umbilicaria propagulifera* (Vainio) Llano, a taxon originally described by Vainio (1903: 10) from Détroit de Gerlache, Antarctica, as a forma of *Gyrophora cylindrica* [syn.:*Umbilicaria cylindrica* (L.) Del. ex Duby]. Vainio's forma was made into species (*Gyrophora propagulifera*) by Räsänen (1937) and subsequently combined into *Umbilicaria* by Llano (1950: 162). The recent revision of the genus *Umbilicaria* in East Africa by Krog & Swinscow (1986, 1989) does however indicate that *U. propagulifera* is a taxon synonymyous with *Umbilicaria umbilicarioides* (B. Stein) Krog & Swinscow, a Southern Hemisphere taxon. The type specimen of *U. propagulifera* was not available when Krog & Swinscow wrote their study. It has however recently been located and examined by the present author who agrees with their judgement. Krog & Swinscow's (1986) revision appeared too late to be considered by Filson (1987) who revised the Antarctic members of the genus *Umbilicaria*. Thus Filson maintains *U. propagulifera* as one of five valid species from the Antarctic. The main difference between *U. dendrophora* and *U. umbilicarioides* is that the under side of the latter is strongly scabrous, while the former is smooth and even. Complanate rhizinomorphs are uncommon in *U. dendrophora*, but common in *U. umbilicarioides*. The lower side of *U. umbilicarioides* is also usually black in the centre, and black or brown or grey peripherally (see Krog & Swinscow 1986). The average thalloconidium of *U. umbilicarioides* is generally almost twice as large as those of *U. dendrophora* (Hestmark 1990).

The anatomy, morphology and secondary compound chemistry of *U. dendrophora* do however place it firmly in the 'cylindrica group', and thus Krog & Swinscow (1986) suggested that the taxon formed part of the variation range of *U. cylindrica*, interpreting the production of thalloconidial anamorphs as a response to the environmental conditions, notably the "heavy metal" content of the substrate. However, almost twenty other *Umbilicaria* species produce thalloconidia without this particular environmental stimulus. P. F. Scholander, who examined Lynge's "U. vellea" specimens in O in connection with his study of the apothecia in *Umbilicaria* (Scholander 1934), re-labeled them *Umbilicaria cylindrica* var. *delisei* Despr. Among the morphological forms and varieties described within the *U. cylindrica* aggregate *U. dendrophora* does indeed come very close to var. *delisei*. The differences between *U. dendrophora* and *U. cylindrica* var. *delisei* are mainly: 1) Their ecology: *U. dendrophora* is usually found on substrates with an abundance of iron-oxides, in the sub-alpine to low-alpine zones, while *U. cylindrica* var. *delisei* may be found on all siliceous rocks in the middle- to high-alpine zones. 2) Geographical distribution: *U. dendrophora* is presently known

only from Europe while *U. cylindrica* var. *delisei* has a circumpolar distribution (Frey 1936, Llano 1950). One can however expect *U. dendrophora* to be found in a number of new localities, and many specimens in herbaria are likely to be misidentified. 3) Morphology: *U. dendrophora* is commonly somewhat darker grey in colour and less rigid than *U. cylindrica* v. *delisei*. The margins of *U. dendrophora* are often revolute, a trait rarely observed in *U. cylindrica* v. *delisei*. *Umbilicaria dendrophora* shows no transition into other morphotypes of *U. cylindrica*. Transitional forms are commonly found between *U. cylindrica* v. *delisei* and other morphotypes of this species. The fact that *U. dendrophora* has been found growing together with different non-anamorphic morphotypes of *U. cylindrica* seems to suggest that it is separated from the rest of the cylindrica-group. 4) The size of the two species is very different; while var. *delisei* may reach a diameter of up to 26 cm, the largest *U. dendrophora* thallus observed is 8 cm. 5) The presence of thalloconidia in *U. dendrophora*. - Taken together these differences merit specific rank for *U. dendrophora*.

Verified records: 1) Norway, Hordaland, Ulvik, Finse, 800 m NE of railway station, 1350 m, April 1992, Hestmark (O); 2) Norway, Oppland, Lom, Bøverdalen, 1 km NE of Sulheim, 500 m, 1986, Hestmark (O); 3) Norway, Oppland, Vang, Mt. Raudhorn, 1000 m, 18 June 1985, Hestmark (O); also E. Timdal 4462 (O) & 4463 (O); 4) Norway, Oppland, Lom, Vassbergetseter, Høydalen, 950 m, 1957 (O); 5) Norway, Oppland, Dovre, Verkenseter (O); 6) Norway, Nordreisa, Fatavarre, 1 September 1933, Y. M. Mejland (O); 7) Norway, Troms, Balsfjord, Mt Vassdalsfjellet, 480 m, 11 June 1984, E. Timdal 4167 (O); 8) Norway, Troms, Målselv, E. Timdal 4056 (O); 9) Norway, Troms, Lyngen, Lyngseidet, 1910, Lynge (O); 10) Norway, Troms, Storfjord, Mt. Paras, 500 m, 11 July 1984, E. Timdal 4279 (O); also Holtan-Hartwig 4397 (O); 11) Norway, Troms, Storfjord, Signaldalen, Stordalen, by river Stordalselva near Dalheim, 90-120 m, 13 August 1991, R. Haugan H2197 (O); 12) Sweden, Torne Lappmark, Schweden, Abisko, Låktavagge, 1000 m, 16 June 1967, J. Poelt (holotypus: GZU; isotypus: UPS); 13) Sweden, Torne Lappmark, Jukkasjärvi sn, Vassijaure, Kärkejåkka, 700 m; 5 August 1980, J. Poelt (GZU); 14) Poland, Karkonosze, Zakret 'Smierci, 775 m; 4 September 1979, M. R. D. Seaward and E. A. Bylinska (BM); 15) Poland, Karkonosze, Wysoki Kamien, 1000 m; 25 August 1980, M. R. D. Seaward and E. A. Bylinska (hb Seaward 103698); 16) Andorra, Ordino, June 1987, Hestmark (O).

LITERATURE CITED

FILSON, R. (1987). Studies in Antarctic lichens 6: further notes on Umbilicaria. - *Muelleria* 6: 335-347.

FREY, E. (1936) Die geographische Verbreitung der Umbilicariaceen und einiger alpiner Flechten. - *Berichte der Schweizerischen Botanischen Gesellschaft* (Festband Rübel) 46: 412-444.

HASENHÜTTL, G. & POELT, J. (1978). Über die Brutkörner bei der Flechtengattung *Umbilicaria*. - *Ber. Deutsch. Bot. Ges.* 91: 275-296.

HESTMARK, G. (1990). Thalloconidia in the genus *Umbilicaria*. - *Nordic Journal of Botany* 9: 547-574.

KROG, H. & SWINSCOW, T. D. V. (1986). The lichen genera *Lasallia* and *Umbilicaria* in East Africa. - *Nordic Journal of Botany* 6: 75-85.

------- 1989. *Macrolichens of East-Africa.* British Museum. Natural History.

LLANO, G. A. (1950). *A Monograph of the Lichen Family Umbilicariaceae in the Western Hemisphere.* - Navexos P-831. Office of Naval Research. Department of the Navy, Washington, D. C.

MENLOVE, J. E. (1974). Thin-layer chromatography for the identification of lichen substances. - *British Lichen Society Bulletin* 34: 3-5.

RÄSÄNEN, V. (1937). Liquenes Chilenos. - *Rev. Univ. (Universidad Catolica, Santiago de Chile)* 23 (1): 195-221.

SCHOLANDER, P. F. (1934). On the Apothecia in the Lichen Family Umbilicariaceae. - *Nyt Magasin for Naturvidenskaberne* 75: 1-31, Pl.I-V.

SEAWARD, M. R. D., BYLINSKA, E. A. & TOPHAM, P. B. (1983). The Distribution and Ecology of *Umbilicaria propagulifera* (Vainio) Llano. - *Nova Hedwigia* 38: 703-716.

TOPHAM, P. B., SEAWARD, M. R. D. & BYLINSKA, E. A. (1982). *Umbilicaria propagulifera* new to the northern hemisphere. - *The Lichenologist* 14: 47-52.

VAINIO, E. A. (1903). *Résult. Voyage S. Y. Bélgica.* 6. Botanique. Lich.p. 1-46.

MYCOTAXON

Volume XLVI, pp. 217-234 January-March 1993

ADDITIONS TO CALONECTRIA

P.W. CROUS
Department of Plant Pathology, University of Stellenbosch, 7600 Stellenbosch, South Africa

M.J. WINGFIELD
Department of Microbiology and Biochemistry, University of the Orange Free State, P.O. Box 339, 9300 Bloemfontein, South Africa

AND

A.C. ALFENAS
Departemento de Fitopatologia da Universidade Federal de Viçosa, 36570 Viçosa, Brasil

The genus *Calonectria* De Not. was circumscribed by Rossman (1979), who examined the type species, *Calonectria pyrochroa* (Desm.) Sacc. In subsequent treatments (Boesewinkel, 1982, Rossman, 1983), the genus was characterised as having *Cylindrocladium* Morgan anamorphs, scarlet to dark umber (KOH +) ascocarps with scaly to warty walls, and narrowly-stalked, broadly clavate asci, with curved to fusoid ascospores, having one to several septa, and acuminate in the upper part of the ascus.

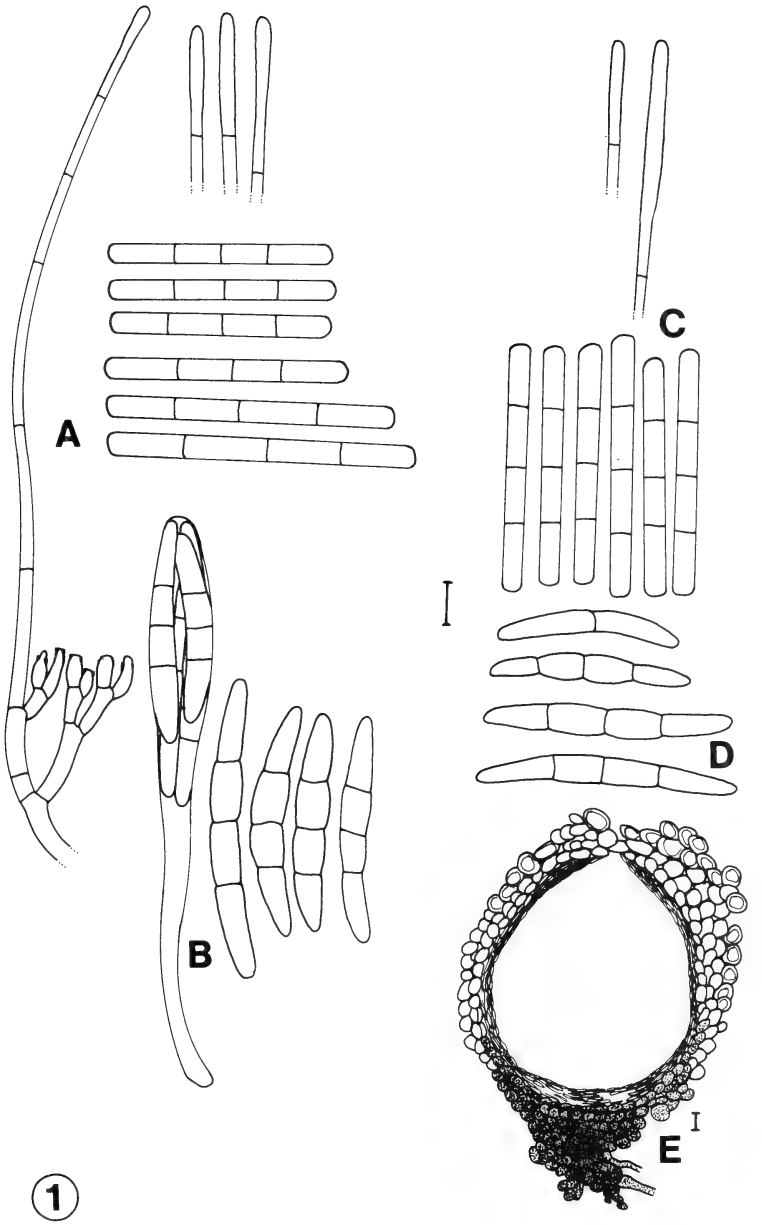
Although there have been several studies reporting the homothallic nature of *Cylindrocladium* spp. (Sobers, 1972; Peerally, 1973; Alfieri, El-Gholl & Schoulties, 1982; El-Gholl, Schoulties & Alfieri, 1983), few reports have referred to heterothallism in *Cylindrocladium*, the first made only in 1974 (Sobers, 1974), referring to the teleomorph of *Cylindrocladium scoparium* Morgan. Subsequent to this report, several *Calonectria* spp. have been described from paired haploid conidial isolates (Ribeiro, 1978; Schubert, El-Gholl, Alfieri & Schoulties, 1989; Peerally, 1991). We therefore assume that many well-known *Cylindrocladium* spp. that consistently occur in the absence of their teleomorphs, are probably heterothallic.

The present study reports three new *Calonectria* spp. Two of these are the heterothallic teleomorphs of *Cylindrocladium pteridis* Wolf, and a new variety of *Cylindrocladium colhounii* Peerally, respectively. The third species is homothallic, and is the teleomorph of *Cylindrocladium gracile* (Bugn.) Boesewinkel.

Calonectria colhounii Peerally was described from leaf spots on *Camellia sinensis* (L.) Kuntze in Mauritius in 1973 (Peerally, 1973). This species is homothallic, and produces bright yellow perithecia with four 3-septate ascospores per ascus (Peerally, 1973). The presence of yellow perithecia with 4-spored asci is an unique feature in *Calonectria* (Rossman, 1983). The *Cylindrocladium* anamorph, however, is distinguished from other *Cylindrocladium* spp. by having 3-septate conidia, measuring 38.0-84.0 x 3.4-5.7 μm, and stipes terminating in clavate vesicles (Peerally, 1974).

During routine collections from a forest nursery in the Sabie area, Eastern Transvaal, South Africa, a severe disease of *Eucalyptus* cuttings was found. The causal organism was characterized by having large, warty, yellow perithecia, with four 3-septate ascospores per ascus, typical of *C. colhounii*. Single-ascospore isolations produced a *Cylindrocladium* anamorph with 3-septate conidia and stipes terminating in clavate vesicles. The teleomorph could, however, not be induced in culture on either 2 % malt-extract agar (MEA) or carnation-leaf agar (CLA) (Crous, Phillips & Wingfield, 1992). Although the *Calonectria* state was similar to that of the type of *Calonectria colhounii* (IMI 167581), the anamorph exhibited some very clear differences. Conidia were 3-septate, but much larger than those of *C. colhounii*, being (86.0)-97.0-(112.0) x (5.5)-6.5-(8.0) μm in size. Moreover, phialides were allantoid to cylindrical, and not doliiform as found on the type of *C. colhounii*. Stipes were also longer, being up to 320.0 μm in length, whereas those of *C. colhounii* were found to be less than 280.0 μm in length.

Fig. 1A-E. *Calonectria colhounii* var. *colhounii* and its anamorph *Cylindrocladium colhounii* var. *colhounii* on CLA. A, conidiophore, vesicles and conidia; B, ascus and ascospores (PPRI 4183); C, vesicles and conidia; D, ascospores (bar = 10 μm); E, vertical section through a perithecium on agar (IMI 167581, type) (bar = 20 μm).



1

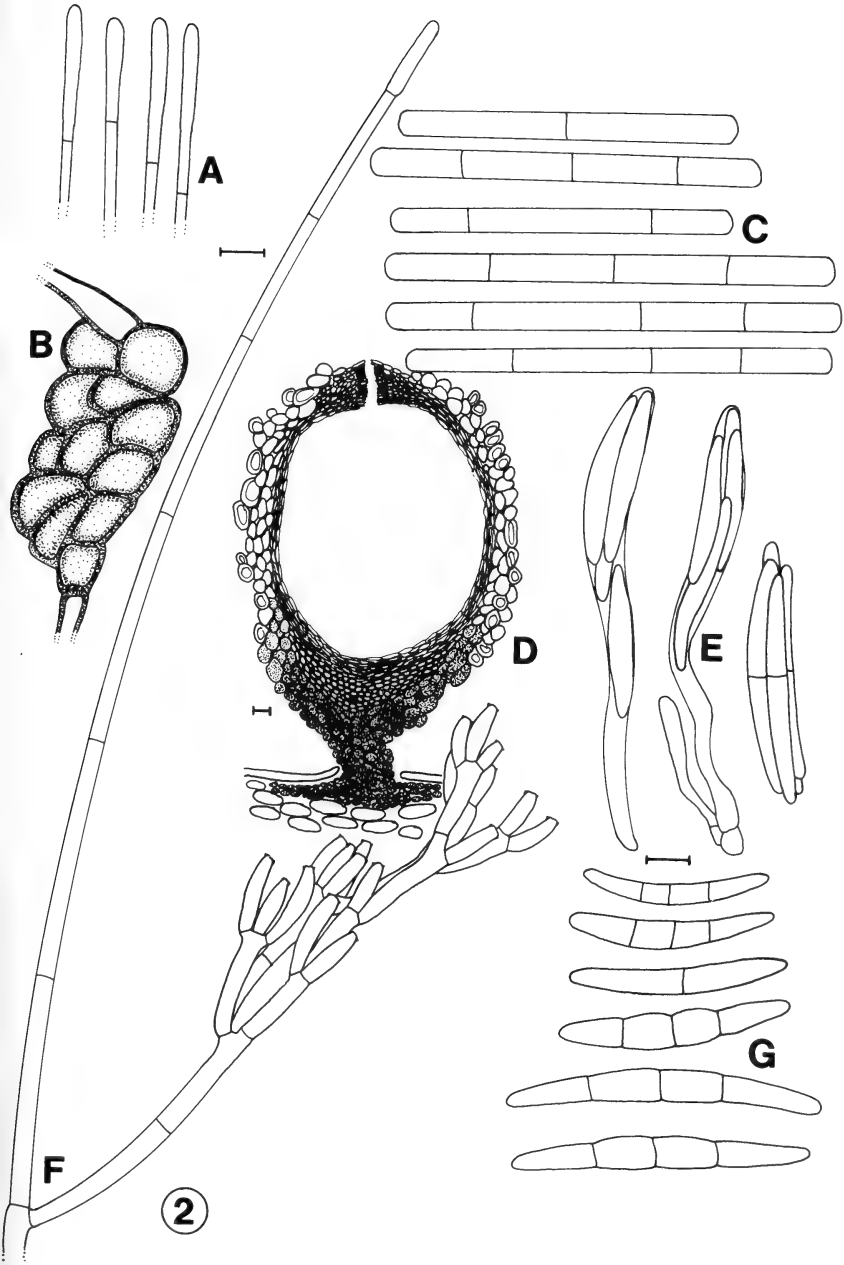
Based on the morphological differences mentioned above, as well as the identical and unique teleomorphs, the South African collection is described as a new variety of *Cylindrocladium colhounii* below:

Cylindrocladium colhounii Peerally var. **colhounii** Fig. 1.
C. colhounii Peerally var. *colhounii Trans. Br. mycol. Soc.* **61**, 92 (1973).
Holomorph: *Calonectria colhounii* Peerally var. *colhounii*
Calonectria colhounii Peerally *Trans. Br. mycol. Soc.* **61**, 92 (1973).

Specimens: India: *Canavalia ensiformis* (L.) DC., 1986, IMI 308494. Mauritius: *Camellia sinensis*, M.A. Peerally, 1972, IMI 167581 (holotype).

Cultures: Australia: *Arachis pintoi*, D. Hutton, N8335, N8710, N9060, N9190, PPRI 4735-4738. Colombia: *Centrosema* sp., J.M. Lenné, 1990, PPRI 4748. USA: unknown hosts, A. Alfenas, (Viçosa, Brazil, UFV 4A, UFV 52A, PPRI 4182, 4185; Hawaii, unknown host, Goos, UFV 22A, 51A, CTR 69-19, PPRI 4183-4184; North Carolina, Macon Co., Nantahala National Forest, Ellicott Rock Trail from Bull Pen Road along Chattooga River, on fallen cones of white pine, *Pinus strobus*, C.T. Rogerson & G.J. Samuels, 4 Oct. 1972, C.T. Rogerson 72-346, ATCC 44542, UFV 53A, 65A, PPRI 4186-4187; Louisiana, *Ficus carica* L., G.E. Holcomb, summer 1991, AR 2684, PPRI 4739; Virginia, Giles Co., Cascades Recreation site, 4 miles north of Pembroke, 37° 23 N, 80° 35 W, pericarp of *Carya* nut, G.J. Samuels, 18 Sept. 1991, GJS 91-117, PPRI 4740.

Fig. 2A-G. *Calonectria colhounii* var. *macroconidialis* and its anamorph *Cylindrocladium colhounii* var. *macroconidialis*. A, vesicles; B, chlamydospores; C, conidia on CLA (bar = 10 μm); D, v.s. through a perithecium on *Eucalyptus* cuttings (bar = 20 μm); E, asci and ascospores; F, conidiophore; G, ascospores (PREM 51036) (bar = 10 μm).


A
B
C
D
E
F
G
2

Cylindrocladium colhounii Peerally var. **macroconidialis** Crous, Wingfield & Alfenas var. nov. Fig. 2.
Holomorph: **Calonectria colhounii** Peerally var. **macroconidialis** Crous, Wingfield & Alfenas var. nov.

Cylindrocladium colhounii var. **macroconidialis** Crous, Wingfield & Alfenas var. nov.

Cylindrocladii colhounii var. *colhounii* similis, sed filum (240.0)-280.0-(320.0) μm longum, *phialides* cylindrici ad allantoidei, (12.0)-20.0-(25.0) x (3.5)-4.0-(5.0) μm, *conidia* 3-septata, (86.0)-97.0-(112.0) x (5.5)-6.5-(8.0) μm.

Status holomorphicus: **Calonectria colhounii** var. **macroconidialis** Crous, Wingfield & Alfenas var. nov.

Omnia var. *colhounii* sed statu anamorphico differt, filum (240.0)-280.0-(330.0) μm longum, *phialides* cylindrici ad allantoidei, (12.0)-20.0-(25.0) x (3.5)-4.0-(5.0) μm, *conidia* 3-septata, (86.0)-97.0-(112.0) x (5.5)-6.5-(8.0) μm.

Morphologically similar to var. *colhounii*. *Macroconidiophores*. *Filament* septate, hyaline, terminating in a narrowly clavate vesicle, (3.0)-4.0-(5.0) μm diam.; stipes (240.0)-280.0-(320.0) μm long. *Conidiophore branches*, primary branches non-septate to 1-septate, (20.0)-30.5-(48.0) x (4.0)-4.5-(5.0) μm; secondary branches non-septate to rarely 1-septate, (20.0)-25.0-(30.0) x (4.0)-4.5-(5.0) μm; tertiary and quatenary branches non-septate, (18.0)-20.0-(30.0) x (4.0)-4.5-(5.0) μm. *Phialides* allantoid to cylindrical, hyaline, non-septate, (12.0)-20.0-(25.0) x (3.5)-4.0-(5.0) μm. *Conidia* cylindrical, hyaline, (1)-3-septate, rounded at both ends, (86.0)-97.0-(112.0) x (5.5)-6.5-(8.0) μm. Cultural characteristics identical to var. *colhounii*. Isolates of var. *macroconidialis* do, however, grow faster than those of var. *colhounii* and have medium numbers of chlamydospores on MEA after 6 d at 25 C in the dark.

Teleomorph. Perithecia morphologically and anatomically identical to those of var. *colhounii*.

Type: South Africa: E. Tvl., Frankfort, *Eucalyptus* cuttings, P.W. Crous, 16 Apr. 1991, PREM 51035, holotype of anamorph; E. Tvl., Frankfort, *E. grandis* cuttings, P.W. Crous, March 1990, PPRI 51036, holotype of teleomorph.

Symptoms: leaf spot, root rot, wilt.

Hosts: *Eucalyptus grandis* W. Hill : Maiden.

Distribution: South Africa.

Specimens: Africa: RSA, E. Tvl., Sabie, Frankfort, *Eucalyptus* cuttings, P.W. Crous, 16 Apr. 1991, PREM 51035, holotype of anamorph; RSA, E. Tvl., Sabie, Frankfort, *E. grandis* cuttings, P.W. Crous, March 1990, PREM 51036, holotype of teleomorph.

Cultures: Africa: RSA, E. Tvl., Sabie, Frankfort, *E. grandis* cuttings, P.W. Crous, March 1990, PPRI 4000; RSA, E. Tvl., Sabie, Frankfort, D.R. de Wet clone bank, *E. grandis* ramets (roots), P.W. Crous, 11 May 1990, PPRI 4001.

Cylindrocladium gracile was initially described as a *Cylindrocarpon* sp. from *Argyreia splendens* (Roxb.) Sweet in Indo China (Bugnicourt, 1939). In a review of *Cylindrocarpon* Wollenw., Booth (1966) discussed the morphology of this species, and noted that the conidiophore apparatus did not fit the general trend for the genus. The differences observed by Booth were recognized by Boesewinkel as representative of the genus *Cylindrocladium*, leading him to transfer this species to the latter genus as *C. gracile* (Bugn.) Boesew. (Boesewinkel, 1982). Boesewinkel justified the establishment of a new species of *Cylindrocladium* by stating that it had 3-6-septate stipes, 1-septate conidia

and narrowly clavate vesicles. A comparison of the type of *C. gracile* (PC 551197) with that of a similar species, *C. clavatum* Hodges & May (BPI 414550), showed that *C. gracile* could be distinguished by having longer stipes and larger conidia.

Cylindrocladium gracile has recently been reported from Canada (Chang & Blenis, 1987), but this is the first report of this species from Brazil. Single-conidial isolates also gave rise to a previously undescribed *Calonectria* species on CLA. The teleomorph is described for the first time as follows:

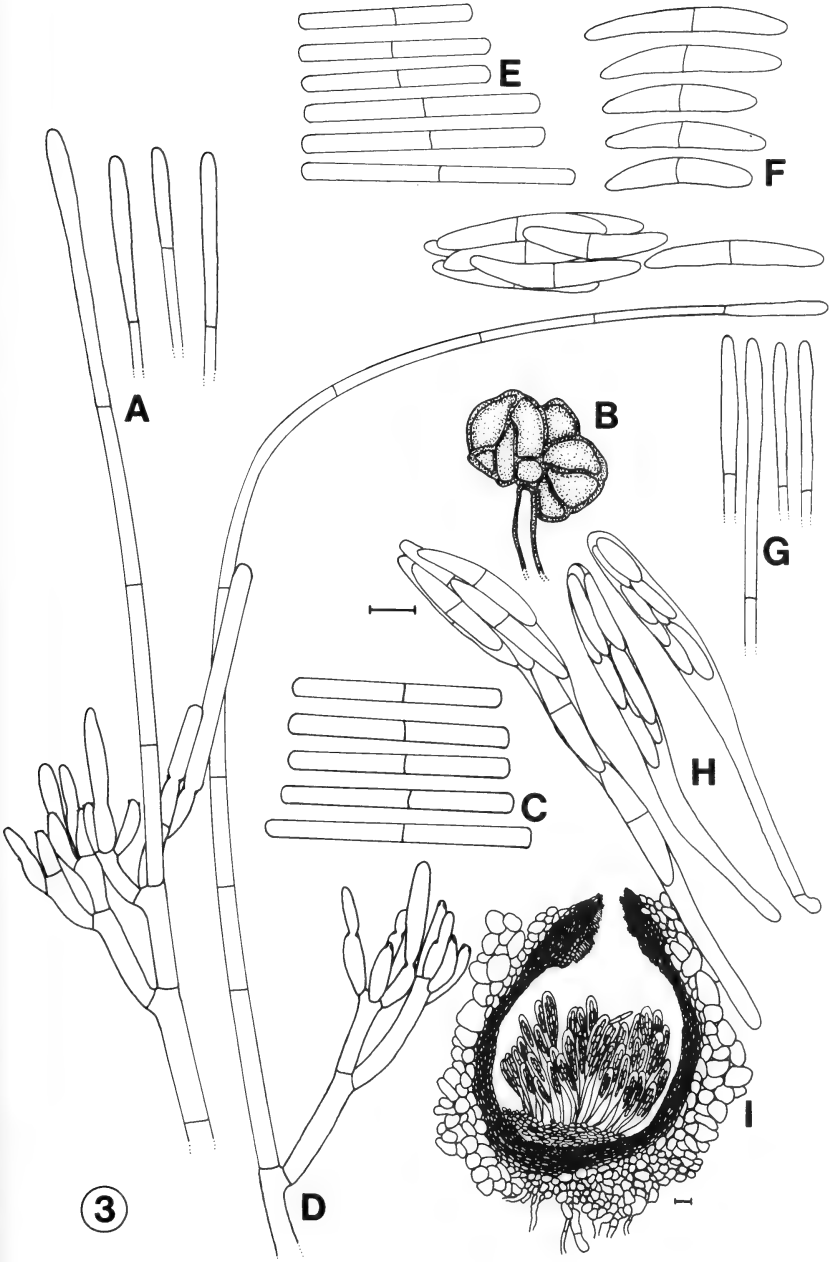
Cylindrocladium gracile (Bugn.) Boesewinkel *Trans. Br. mycol. Soc.* **78**, 554 (1982). Fig. 3
Cylindrocarpon gracile Bugnicourt *Encycl. Mycol.* **11**, 162 (1939).
Holomorph: **Calonectria gracilis** Crous, Wingfield & Alfenas sp. nov.

Macroconidiophores. *Filament* septate, hyaline, terminating in a narrowly clavate vesicle, (2.5)-3.6-(5.0) μm diam.; stipes (160.0)-220.0-(350.0) μm long. *Conidiophore branches*, primary branches non-septate or rarely 1-septate, (14.0)-18.0-(25.0) x (3.5)-4.0-(4.5) μm; secondary branches non-septate, (12.0)-14.2-(16.0) x (3.5)-4.0-(4.5) μm. *Phialides* doliiform to reniform, hyaline, non-septate, (10.0)-12.5-(15.0) x (3.5)-4.0-(4.5) μm. *Conidia* cylindrical, hyaline, 1-septate, rounded at both ends, (40.0)-56.0-(65.0) x (4.0)-4.5-(5.0) μm.

Calonectria gracilis Crous, Wingfield & Alfenas sp. nov.

Perithecia superficialia, singulatim aut in turmis parvis portata, globosa vel subglobosa, 350.0-400.0 x 330.0-380.0 μm, rubri-brunnea usque ad rubra, pariete exteriore aspero verrucosoque et ostiolo

Fig. 3A-I. *Calonectria gracilis* and its anamorph *Cylindrocladium gracile* on CLA. A, conidiophore and vesicles; B, chlamydospores; C, conidia (PC 551197, type); D, conidiophore (PREM 51031, type of teleomorph); E, conidia; F, ascospores; G, vesicles; H, asci (bar = 10 μm); I, v.s. through a perithecium (bar = 20 μm).


E
F
A
B
G
H
C
I
D
3

papillato. *Asci* hyalini, clavati ad longum caulem et tenuum contracti, (75.0)-90.0-(100.0) x (8.0)-10.0-(15.0) μm, 8 ascospori. *Ascosporae* hyalinae, rectae vel falcatae, guttulatae, 1-septatae, ad septam medianam non constrictae, (27.0)-36.5-(50.0) x (4.0)-5.0-(6.0) μm.

Perithecia superficial, borne singly or in small groups, globose to subglobose, 350.0-400.0 x 330.0-380.0 μm, with warty outer wall and papillate ostiole, red to red-brown, turning blood-red in 3 % KOH. *Asci* hyaline, clavate, (75.0)-90.0-(100.0) x (8.0)-10.0-(15.0) μm, tapering to a long thin stalk, containing 8 ascospores. *Ascospores* hyaline, straight or falcate, guttulate, 1-septate, not constricted at median septum, (27.0)-36.5-(50.0) x (4.0)-5.0-(6.0) μm.

Type: South East Asia (Indo China): *Argyreia splendens*, 1937, Bugnicourt, derived from Paris, PC 551197, PREM 51032, holotype of anamorph. Brazil: Para, near Belem, *Manilkara zapota* (L.) Van Royen, 1990, F. Carneiro de Albuquerque, PREM 51031, holotype of teleomorph.

Symptoms: root rot.

Hosts: *Manilkara zapota*, *Argyreia splendens*, *Pahudia cochinchinensis* Pierre, (Bugnicourt, 1939).

Distribution: Brazil, Canada, South East Asia (Indo China) (Bugnicourt, 1939; Chang & Blenis, 1987).

Specimens: South East Asia (Indo China): *C. gracile*, *Argyreia splendens*, 1937, Bugnicourt, derived from Paris No. 551197, IMI 117577.

Cultures: South East Asia (Indo China): Herb. Paris (PC) No. 551197, type culture. Brazil: PA, Belem, *M. zapota*, F. Albuquerque, PPRI 4176.

Cylindrocladium pteridis has the longest conidia of all 1-septate *Cylindrocladium* spp., frequently being longer than 100.0 μm. Furthermore, it is the only *Cylindrocladium* sp. that produces curved microconidia (Peerally, 1991). Although *C. macrosporum* is a synonym of *C. pteridis* (Sobers, 1968), many researchers continue to use the name *C. macrosporum* (Renard & Viennot-Bourgin, 1973; Renard & Quillec, 1979; Ahmad & Ahmad, 1982) rather than the correct name *C. pteridis*.

Sobers (1968) showed that the type culture of *C. macrosporum* could produce microconidia when cultured on water agar. This was the first time that a microconidial state had been described in a species of *Cylindrocladium*. In the original description (Sherbakoff, 1928), microconidia are illustrated, but were not mentioned prior to the study in which Sobers (1968) placed *C. macrosporum* in synonymy under *C. pteridis*. Sobers (1968) stated that microconidia did not give rise to both conidial types when single-spored. In the present study, single microconidia from *C. pteridis* commonly gave rise to both conidial types in culture.

One isolate (ATCC 34395) was observed to form protoperithecia when cultured on CLA. When this isolate was paired on CLA with other isolates of *C. pteridis* using the methods explained in Ribeiro (1978), perithecia developed. However, although perithecia developed easily on CLA, they were never fertile. Fertile perithecia could only be obtained by incubating plates at 15 C for 2 mo. Cultures used in the pairings were representative of two types, (-) and (+) respectively. Fertile perithecia were obtained by pairing one (-) isolate with a (+) isolate. Isolates used in pairings for fertile perithecia were the following: (+) PPRI 4180, 4181; (-) PPRI 4157, 4177, 4178, ATCC 34395. *Calonectria pteridis*, the teleomorph of *Cylindrocladium pteridis*, is described below:

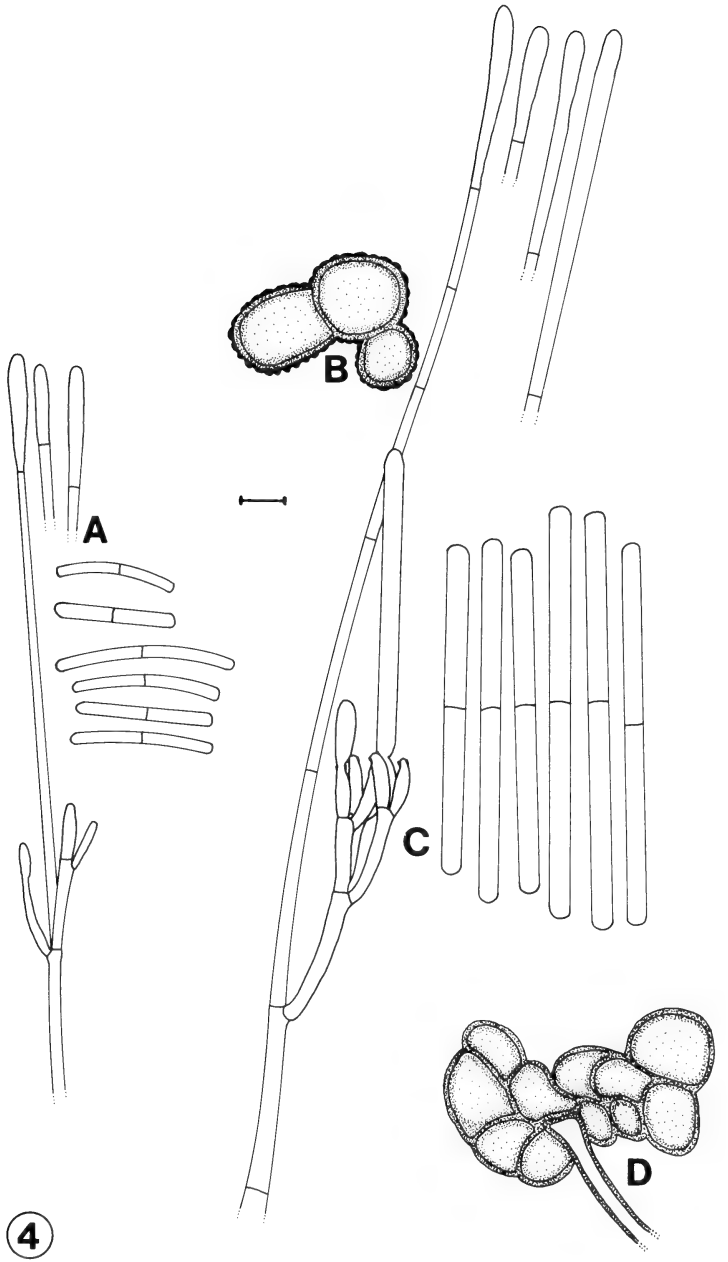
Cylindrocladium pteridis Wolf *J. Elisha Mitchell Sci. Soc.* **42**, 59 (1926).
Figs 4, 5
Cylindrocladium macrosporum Sherb. *Phytopathology* **18**, 222 (1928).
Holomorph: **Calonectria pteridis** Crous, Wingfield & Alfenas sp. nov.

Macroconidiophores. *Filament* septate, hyaline, terminating in a clavate vesicle, (4.0)-4.5-(5.5) μm diam.; stipes (150.0)-240.0-(300.0) μm long. *Conidiophore branches*, primary branches non-septate or rarely 1-septate, (18.0)-28.0-(32.0) x (4.0)-4.8-(6.0) μm; secondary branches non-septate, (16.0)-20.0-(30.0) x (3.5)-4.0-(5.5) μm; tertiary branches non-septate, (14.0)-18.0-(22.0) x (3.5)-4.0-(4.5) μm. *Phialides* elongate, doliiform to reniform, hyaline, non-septate, (12.0)-15.5-(22.0) x (3.5)-4.0-(5.0) μm. *Conidia* cylindrical, hyaline, 1-(3)-septate, rounded at both ends, (62.5)-82.0-(121.0) x (4.5)-5.0-(6.0) μm.

Microconidiophores. *Filament* septate, hyaline, terminating in a clavate vesicle. *Conidiophore branches*, primary branches non-septate to rarely 1-septate, (20.0)-28.0-(50.0) x (3.0)-4.5-(5.0) μm; secondary branches non-septate to rarely 1-septate, (18.0)-20.0-(30.0) x (2.5)-3.0-(3.5) μm; tertiary branches non-septate, (16.0)-18.0-(23.0) x (2.5)-3.0-(3.5) μm. *Phialides* arise from the ends of branches, in groups of 2-4; phialides cylindrical, hyaline, non-septate, (10.0)-15.0-(21.0) x (2.5)-3.0-(3.5) μm, collarettes absent in some isolates, inconspicuous in others. *Conidia* cylindrical, curved or straight, hyaline, 1-septate with obtuse ends, (18.5)-29.5-(40.0) x (2.5)-3.5-(4.0) μm.

Calonectria pteridis Crous, Wingfield & Alfenas sp. nov.
Perithecia superficialia, singulatim aut in turmis parvis portata, globosa vel subglobosa, 400.0-500.0 x 300.0-350.0 μm, rubri-brunnea ad rubra, pariete exteriore aspero verrucosoque et ostiolo papillato. *Asci* hyalini, clavati ad caulem longum et tenuum contracti, (100.0)-120.0-(180.0) x (9.0)-15.0-(27.0) μm, 1-8 ascospori. *Ascosporae* hyalinae, rectae vel falcatae, 1-(3)-septatae, plerumque ad septum non constrictae (30.0)-51.5-(75.0) x (4.5)-5.5-(7.0) μm. Ascosporae usque ad 6 septis ubi ab asco dimissae.

Fig. 4A-D. *Cylindrocladium pteridis*, anamorph of *Calonectria pteridis* on CLA (bar = 10 μm). A, microconidiophore, vesicles and conidia on CLA; B, chlamydospores on MEA after 7d; C, macroconidiophore, vesicles and conidia on CLA; D, chlamydospores on CLA after 7d (PPRI 4157).



④

Perithecia superficial, borne singly or in small groups, globose to subglobose, 400.0-500.0 x 300.0-350.0 μm, with warty outer wall and papillate ostiole, red to red-brown, turning blood-red in 3 % KOH. *Asci* hyaline, clavate, (100.0)-120.0-(180.0) x (9.0)-15.0-(27.0) μm, tapering to a long thin stalk, containing 1-8 ascospores. *Ascospores* hyaline, straight or falcate, 1-(3)-septate, generally not constricted at septa, (30.0)-51.5-(75.0) x (4.5)-5.7-(7.0) μm. Ascospores with up to 6 septa once discharged from the ascus.

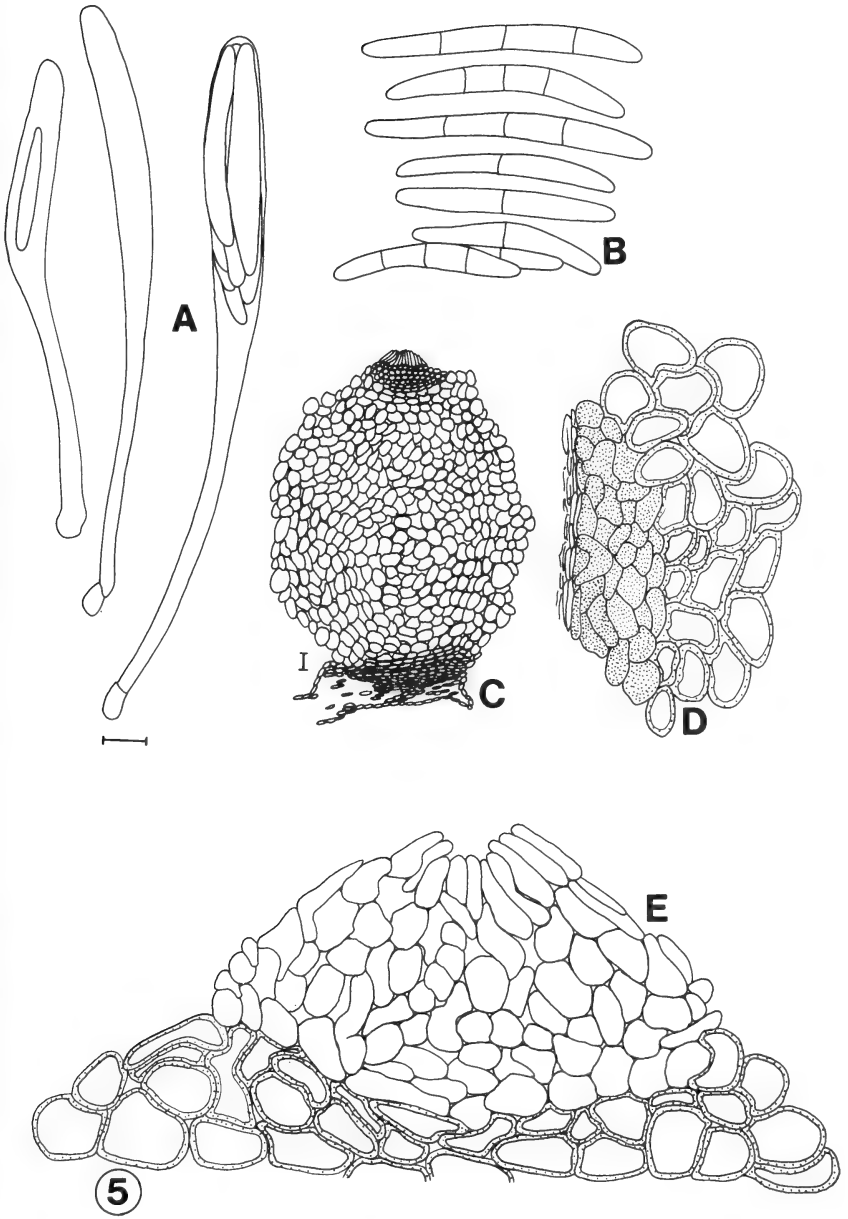
Type: USA: Florida, Orlando, *Rumohra adiantiformis* (G. Forst.) Ching (=*Polystichum adiantiforme* (Forst.) J.E. Sm.), F.A. Wolf, Oct. 1926, BPI 414564, holotype of anamorph. Brazil: *Pinus* sp., T.L. Krügner, PPRI 4177 x *Eucalyptus grandis*, A.C. Alfenas, PPRI 4180, PREM 51033, holotype of teleomorph; *Pinus caribaea*, T.L. Krügner, PPRI 4178 x *Eucalyptus grandis*, A.C. Alfenas, PPRI 4180, PREM 51034, paratype of teleomorph.

Symptoms: causing leaf spots and root disease (Sobers, 1968).

Hosts: *Arachis hypogaea* L., *Arachnoides adiantiformis*, *Arecastrum romanzoffianum* (Cham.) Becc., *Asparagus plumosus* Baker, *Callistemon* spp., *Chamaedorea elegans* Schrad., *Cocos nucifera* L., *Collinia elegans* Liebm., *Dryopteris* sp., *Eucalyptus* spp., *Howeia* spp., *Lupinus* spp., *Melaleuca leucadendra* L., *Pinus caribaea* var. *hondurensis*, *Rhododendron obtusum* Planch., *Strelitzia reginae* Banks and *Washingtonia robusta* Wendl. (Wolf, 1926; Sherbakoff, 1928; Sobers, 1967; Sobers, 1968; Sobers & Alfieri, 1972).

Distribution: Africa, Brazil, India, Florida, U.S.A. (Wolf, 1926; Sobers, 1968; Sobers & Alfieri, 1972; Bedendo & Krügner, 1987).

Fig. 5A-E. *Calonectria pteridis*, teleomorph of *Cylindrocladium pteridis* on CLA. A, asci; B, ascospores (bar = 10 μm); C, perithecium (bar = 20 μm); D, transverse section through perithecium wall; E, ostiolar region of a perithecium (PREM 51033, type) (bar = 10 μm).


A
B
C
D
E
5

Specimens: Africa: *Pinus caribaea* var. *hondurensis*, 1972, Ivory, IMI 164169; *P. oocarpa*, Ivory, IMI 164168. India: *Cocos nucifera*, ?, 1973, IMI 174348. USA: *Washingtonia robusta*, C.D. Sherbakoff, Jan 1928, BPI 414558; Florida, near Sebring, *Washingtonia robusta*, C.D. Sherbakoff, Dec. 1927, BPI 414559; Florida, Orlando, *Rumohra adiantiformis*, F.A. Wolf, Oct. 1926, BPI 414564.

Cultures: Brazil: unknown host, J.C. Dianese, (Viçosa, Brazil, No. UFV 43), PPRI 4157; needles of a *Pinus* sp., T.L. Krügner, (Viçosa, Brazil, No. UFV 10) PPRI 4177; needles of *Pinus caribaea*, T.L. Krügner, (Viçosa, Brazil, No. UFV 37) PPRI 4178; *Eucalyptus grandis* leaves, A.C. Alfenas, (Brazil, Viçosa, No. UFV 105) PPRI 4180. USA: *Arachnoides adiantiformis*, F. Schickedanz, 1974, ATCC 34395; Florida, *Rumohra adiantiformis*, N.E. El-Gholl, (Brazil, Viçosa, No. UFV 50) PPRI 4179; *Eucalyptus* sp., C.S. Hodges, (Brazil, Viçosa, No. UFV 92) PPRI 4181.

ACKNOWLEDGEMENTS

We wish to thank Dr. N.E. El-Gholl (Florida Dept. of Agric & Consumer Services, USA) and Prof. W.F.O. Marasas (Medical Res. Council, Tygerberg, South Africa) for their review of the manuscript. We also thank Drs. Amy Rossman and Gary Samuels, Beltsville Agricultural Research Centre (BPI), for placing several of their *Calonectria* collections at our disposal. The supply of cultures of *C. colhounii* by Dr. D. Hutton, Queensland Dept. of Primary Industries, Australia, and Dr. J.M. Lenné, CIAT, Colombia is gratefully acknowledged. We also thank Dr. J. Mouchacca, Laboratoire de Cryptogamie, Paris, for supplying the type culture of *C. gracile*, Dr. D. Brayford, IMI, Blakeham Lane, Egham, Surrey, UK, and ATCC, Parklawn Drive, Rockville, USA, for the loan of specimens and cultures used in this study. Several other researchers have also supplied cultures, and their assistance is gratefully acknowledged.

REFERENCES

Ahmad, N. & Ahmad, S. (1982). Needle blight disease of pine caused by *Cylindrocladium macrosporum*. *Malaysian Forrester* **45**, 84-86.

Alfieri, S.A., El-Gholl, N.E. & Schoulties, C.L. (1982). Homothallism in *Calonectria ilicicola*. *Mycologia* **74**, 513-514.

Bedendo, I.P. & Krügner, T.L. (1987). Fungitoxicity of benomyl and chlorothalonil to *Cylindrocladium pteridis* and its persistence after spraying on leaves of *Eucalyptus cloeziana*. *Fitopatologia Brasileira* **12**, 236-239.

Boesewinkel, H.J. (1982). Heterogeneity within *Cylindrocladium* and its teleomorphs. *Transactions of the British Mycological Society* **78**, 553-556.

Booth, C. (1966). The genus *Cylindrocarpon*. *Mycological Papers* **104**, 1-56.

Bugnicourt, F. (1939). Les *Fusarium* et *Cylindrocarpon* de l'Indochine. *Encyclopedie Mycologique* **11**, 1-206.

Chang, K.F. & Blenis, P.V. (1987). Pathogenicity testing of three fungi recovered from roots and crowns of diseased alfalfa in central Alberta. *Canadian Plant Disease Survey* **67**, 11-13.

Crous, P.W., Phillips, A.J.L. & Wingfield, M.J. (1992). Effects of cultural conditions on vesicle and conidium morphology in species of *Cylindrocladium* and *Cylindrocladiella*. *Mycologia* **84**, 497-504.

El-Gholl, N.E., Schoulties, C.L. & Alfieri, S.A. (1983). Homothallism in *Calonectria theae*. *Mycologia* **75**, 162-163.

Peerally, A. (1973). *Calonectria colhounii* sp. nov. a common parasite of tea in Mauritius. *Transactions of the British Mycological Society* **61**, 89-93.

Peerally, A. (1974). *Calonectria colhounii*. CMI Descriptions of Pathogenic Fungi and Bacteria No. 430.

Peerally, A. (1991). The classification and phytopathology of *Cylindrocladium* species. *Mycotaxon* **40**, 323-366.

Renard, J.L. & Quillec, G. (1979). Diseases and anomalies of oil palm in the nursery. *Oleagineux* **34**, 331-337.

Renard, J.L. & Viennot-Bourgin, G. (1973). A new disease of the oil palm due to *Cylindrocladium macrosporum*. *Oleagineux* **28**, 443-445.

Ribeiro, J.O. (1978). Heterotalismo em *Cylindrocladium scoparium* Morgan. M.Sc. thesis, Universidade Federal de Viçosa, Minas Gerais, Brazil. 33pp.

Rossman, A.Y. (1979). *Calonectria* and its type species, *C. daldiniana*, a later synonym of *C. pyrochroa*. *Mycotaxon* **8**, 321-328.

Rossman, A.Y. (1983). The phragmosporous species of *Nectria* and related genera. *Mycological Papers* **150**, 1-164.

Schubert, T.S., El-Gholl, N.E., Alfieri, S.A. & Schoulties, C.L. (1989). *Calonectria avesiculata* sp. nov. *Canadian Journal of Botany* **67**, 2414-2419.

Sherbakoff, C.D. (1928). Washington palm leaf spot due to *Cylindrocladium macrosporum* n. sp. *Phytopathology* **18**, 219-225.

Sobers, E.K. (1968). Morphology and host range of *Cylindrocladium pteridis*. *Phytopathology* **58**, 1265-1270.

Sobers, E.K. (1972). Morphology and pathogenicity of *Calonectria floridana*, *Calonectria kyotensis* and *Calonectria uniseptata*. *Phytopathology* **62**, 485-487.

Sobers, E.K. (1974). The *Calonectria* state of *Cylindrocladium scoparium*. *Phytopathology* **63**, 448 (Abstr.).

Sobers, E.K. & Alfieri, S.A. (1972). Species of *Cylindrocladium* and their hosts in Florida and Georgia. *Proceedings of the Florida State Horticultural Society* **85**, 366-369.

Wolf, F.A. (1926). Brown leaf spot of leather leaf fern. *Journal of the Elisha Mitchell Scientific Society* **42**, 55-62.

MYCOTAXON

Volume XLVI, pp. 235-240 January-March 1993

NEW HYPHOMYCETES FROM SANTIAGO RIVER. VI. (BUENOS AIRES PROVINCE, ARGENTINA).

CAZAU, M. C.*; A. M. ARAMBARRI** and M. N. CABELLO***.

INSTITUTO "SPEGAZZINI" 53 # 477, 1900 LA PLATA. ARGENTINA.

SUMMARY

Furthering our research on **Hyphomycetes** from Santiago River (Argentina) three new species namely: **Dwayaangam gamundiae Diplocladiella taurina** and **Pleurotheciopsis websterii** are herein described from observations on natural media.

Exsiccata are available at the Spegazzini Institute (LPS)

Dwayaangam gamundiae *sp. nov. Fig.1*

Mycelium ex hyphis hyalinis,laevis ramosis. 2-3 um latis compositum. Conidiophori dispersi, micronemata, curti, leves, ex hyphis ennati. Cellulae conidiogenae monoblasticae, determinatae. Conidia solitaria, staurospora, hyalina multicellularia, basali parte truncata, cylindricae, 4-6 septata, 30-40 x 2-5 um, apicaliter bifurcata, itaque in 1-trunco et 2-ramis primaris et 4-ramis secundaris consistentia, rami primaria, 3-5 cellularis, 20-23 um et rami secundari 50-60 x 4,5-5 um plerumque in 3 vel 4 cellulas divisi.
Holotypus: ARGENTINA, Buenos Aires, Río Santiago, leg. Cazau, II/ 1991, ex cortice putrida, in Herb. LPS 45026 conservatus est.

Etymology: In honour of Dr. Irma J. Gamundí

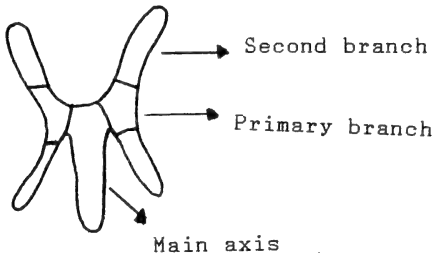
Mycelium composed of branched, septate, smooth walled hyphae, 2,5-3 um diam. Conidiophores micronematous, scattered, usually very short. Conidiogenous cell. apical, discrete, monoblastic, determinate. Conidia solitary, staurosporus, hyaline, multicellular. Each consists of a

---

*) Fellow of the Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina.
**) Researcher of the above Consejo
***) Researcher of the Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, Argentina.

truncate, cylindrical, 4-6 septate main axis, 30-40 x 2-5 um. Axis branched dichotomously at the apex, the primary branches often 20-23 um, mostly 3-cellular; the secondary branches often 50-60 x 4,5-5 um at the base, tapering upward to a diameter of 1,5-2 um near the rounded usually 4-8 celled tip.

We have considered the parts of the conidia as follows to uniform the concepts of it.



The genus **Dwayaangaam** was erected by Subramanian (1977) based on **Triposporina quadridens** Drechsler (Dreschler, 1961), a parasite on testaceous rhizopods. We have compared the four species so far described: **D. cornuta** Descals (Descals & Webster, 1982); **D. dichotoma** Nawawi (Nawawi, 1985); **D. quadridens** (Drechsler) Subramanian (Subramanian, 1977); **D. yakuensis** (Matsushima) Matsushima (Matsushima, 1981), with our species, in the following table:

Species / Characters	D. cornuta Descals	D. dichotoma Nawawi	D. quadridens (Dresch.) Subr.	D. yakuensis (Mats.) Mats. (Matsushima)	D. gamundii sp.nov.
Substrate	in water on organic matter	on foam	parasitic on testaceous rhizopods	on soil and organic matter	in water on organic matter
Second branches	2nd branches formed in 180º angles	2nd branches formed in 45-90º angles	2nd branches formed in 90-110º angles	2nd branches formed in 120-180º angles	2nd branches formed in 180º angles
Main axis	30-52 x 5-7 um	20-32 x 2,5-3 um	45-60 x 1,8 um	12-19 x 4-5 um	30-40 x 2-5 um
Primary branch	2 cells 15 um	3-5 cells 20-32 um	3 cells 20-23 um	2 cells 8-11 um	3 cells 20-23 um
Second branch	30-52 x 5-7 um	28-38 x 2,5-3,5um	20-34 x 4-5,5 um	20-34 x 3-4 um	50-60 x 2-5 um

Our species is closely related in form to **D. yakuensis** and **D. quadridens** but differs in the morphology and the size of the conidia, as can be seen in the above table.

Diplocladiella taurina *sp. nov. Fig.2-3.*

Mycelium partim superficiale, partim in subtrato evolutum, laevibus, fuscis vel brunneis, ramosis, septatis, 2-3 um latis hyphis. Conidiophori dispersi, macronemati, simplices, septati, flexuosi brunnei, ad apicem brunneoli, 26-35 x 4-5 um. Cellulae conidiogenae integratae, terminales, geniculatae, sympodiales, cicatricibus conidiorum in geniculationibus rotundatis. Conidia holoblastica, solitaria, fusca, ramis 2-divergentibus, symmetrica et bilateralia, octocellularia, axis principalis 10-13 um latis, 13-20 um crassa et setula hyalina 20-23 um latis. Holotypus: ARGENTINA , Buenos Aires, Río Santiago, leg. Cazau, 13/III/1991, ex cortice putrida, in Herb. LPS 45027 conservatus est.

Etimology: from Latin taurus: bull; refering to the two appendages resembling the bull's horns.

Mycelium partly superficial, partly immersed, composed of smooth, fuscous to brown, branched, septate, 2-3 um wide hyphae. Conidiophores scattered, macronematous, 26-35 x 4-5 um, unbranched, septate, smooth, brownish, paler at the apex. Conidiogenous cells integrated, terminal, geniculate sympodial, conidial scars situated on rounded shoulders. Conidia solitary, holoblatic, fuscous to dark brown, triangular, 8-celled, distoseptate, consisting of a main axis with 2 divergent arms, bilaterally symmetrical, with two middle oblique septa, separating the arms. Main axis 2-celled, 10-13 um long (measured from the truncate base to the curvature of the arms). The arms (excluding the appendages) are 6-10 x 4-5 um wide at the base, narrowing to 1-1,5 um at the ligther coloured apical cell, ending in a long, thin, hyaline, non-septate appendage, 20-23 um long x 1-1,5 um at the base and 1 um at the apex.

The differences of conidia among the described species: **D. appendiculata** Nawawi (Nawawi,1987); **D. heterospora** Castañeda Ruiz (Castañeda Ruiz, 1988); **D. scalaroides** Arnoud ex Mats. (Matsushima, 1975); **D. tricladioides** Nawawi (Nawawi, 1985) and the new species are shown in the following table:

D. appendiculata Nawawi	D. heterospora Castañeda Ruiz	D. scalaroides Nawawi	D. tricladioides Arnaud ex Mats.	D. taurina sp. nov.
with four appendages	with two appendages	with two appendages	without appendages	with two appendages
Y- shaped	obpyramidal	obpyramidal	equilateral triangle	isosceles triangle
8-celled	variable celled	7-celled	8-celled	8-celled
main axis 26-31 um	main axis 28-35 um	main axis 20-23 um	main axis 30-40 um	main axis 10-13 um
appendage 20-33 um	appendage 20-60 um	appendage 48 um	———	appendage 20-26 um

The closest species is **D. scalaroides** but differs from our species particularly by the shape, size and the long appendages in the conidia.

*Pleurotheciopsis websterii sp nov. Fig.*4-6

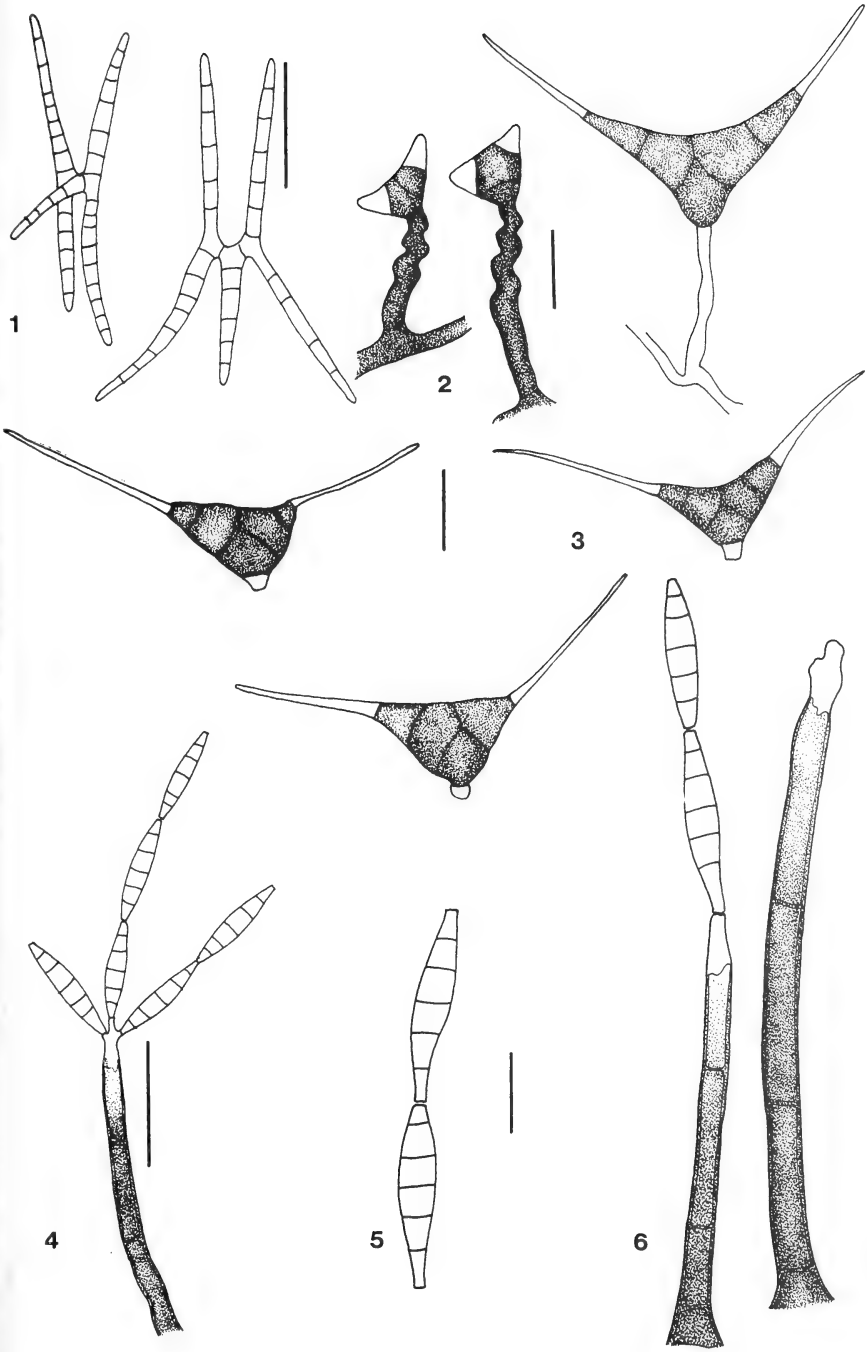
Colonia effusae, pilosae, brunnea. Mycelium ex hyphis ramosis, septatis, brunneis vel atro brunneis, laevibus, 3-6 um diam. compositum. Conidiophora macronemata, mononemata, plerumque flexuosa quam recta, cylindrica non ramosa, septata, laevia ad basim brunnea vel atro brunnea, apicem versus pallidora, 100-150 um longa, 5-9 um crassa. Cellulae conidiogenae integratae, terminales, polyblasticae, sympodiales, cylindricae, pallide brunneae vel hyalinae, parietibus tenuibus, cum 1-5 denticulis. Conidia ex denticulis in catenas distinctas, sicca, non ramosa, acropeta catenata, simplicia, 5 septata, hyalina, laevia, 32-38 x 5-6 um in medio crassa, ad extrema truncata 1-2 um
Holotypus: ARGENTINA, Buenos Aires, Río Santiago, leg. Cazau, IV/1990, ex cortice putrida, in Herb. LPS 45025 conservatus est.

Etimology: In honour of Prof. Dr. John Webster.

Colonies effuse, hairy, brown. Mycelium immersed composed of branched, septate, brown to dark brown, smooth walled hyphae, 3-6 um diam. Conidiophore macronematous, mononematous, straight or more frequently flexuous, cylindrical, unbranched, septate, smooth walled, brown to dark brown at the base, becoming paler towards the apex, 100-150 um long and 5-9 um wide. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cylindrical, pale brown to hyaline, thin walled, with 1-5 short denticles. The outer wall of the conidiogenous cell is broken during the formation of the first conidium and the conidiogenous cells continue to grow up to 20 um above the break. Conidia dry in acropetal chains, simple, 5-septate, hyaline, smooth, fusiform with truncate ends, 32-38 um long, broader in the middle, 5-6 um, at the end, 1-2 um.

Our species is related to P. bramleyi Sutton(1973) but differs from it in the size and septation of the conidia. In P websterii the conidia are 32-38 x 5-6 um, and have 5 septa, meanwhile in P. bramleyi the conidia are 16,5- 25 x 4,5- 6,5 um and 2-3 septate.

DWAYAANGAM GAMUNDIAE 1 Mature conidia.
DIPLOCLADIELLA TAURINA. 2 Conidiophore and conidium, 3. Mature conidiophore and conidium; mature conidia.
PLEUROTHECIOPSIS WEBSTERII. 4. General aspect; 5. Conidia chain, 6. Conidiophore, cellula conidiogenae and chain of conidia.
Bars indicate 20 um.


1
2
3
4
5
6

ACKNOWLEDGEMENTS

We thank Dr. Jorge Wright and Dr. Irma J. Gamundí for their critical review of the manuscript and Nilda Malacalza for inking the drawings.

We acknowledge the Escuela Naval Río Santiago for its colaboration in sampling the area.

REFERENCES

CASTAÑEDA RUIZ, R. F. 1988. Fungi Cubenses III: 8. Inst. Invs Fund. Agric. Trop. "Alejandro Humboldt" Cuba.

DESCALS,E. & J. WEBSTER. 1982. Taxonomic studies on aquatic hyphomycetes III; some new species and a new combination. Trans. Br. Mycol. Soc. 78: 405-437.

DRECHSLER, C. 1961. Some clampless hyphomycetes predacious on nematodes and rhizopods. Sydowia 15: 9-25.

MATSUSHIMA, T. 1981. Saprophytic microfungi from Taiwan. Part 2. Hyphomycetes. Matsushima Mycological Memoirs 2, 1-68.

MATSUSHIMA, T. 1975. Icones Microfungorum a Matsushima Lectorum : 158. Published by the author.Kobe, Japan.

NAWAWI, A. 1985. Some interesting Hyphomycetes from water. Mycotaxon 24: 217-226.

NAWAWI, A. 1987. **Diplocladiella appendiculata** a new aero-aquatic Hyphomycetes. Mycotaxon 28: 297-302.

SUBRAMANIAN, C. V. 1977. Revision of Hyphomycetes. I. Kavaka 5:93-98.

SUTTON, B.C. 1973. Some Hyphomycetes with holoblastic sympodial conidiogenous cells. Trans. Br. Mycol. Soc. 61(3):417-429.

MYCOTAXON

Volume XLVI, pp. 241-258 January-March 1993

NEOCALLIMASTIX VARIABILIS, A NEW SPECIES OF ANAEROBIC FUNGUS FROM THE RUMEN OF CATTLE

Y.W.HO

Department of Biology, Faculty of Science and Environmental Studies, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

D.J.S. Barr

Biosystematics Research Centre, Central Experimental Farm, Research Branch, Agriculture Canada, Ottawa, Ont. Canada.

N. Abdullah, S. Jalaludin

Department of Animal Science, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

H. Kudo

Tropical Agriculture Research Centre, Tsukuba, Ibaraki, Japan.

ABSTRACT

Neocallimastix variabilis sp. nov., an anaerobic fungus from the rumen of cattle is described and illustrated. The fungus is monocentric with sporangia which are developed both endogenously and exogenously. Exogenous sporangia are borne on sporangiophores of variable lengths, from short egg-cup shaped to very long slender tubes of over 700 μm. Sporangia are globose, ellipsoidal, pyriform or irregular. Zoospores are polyflagellate.

The genus *Neocallimastix* was validated by Heath *et al.* (1983) with *N. frontalis* as the type species. The genus is characterised by anaerobic gut fungi with monocentric thalli, filamentous branched rhizoid, globose sporangia and polyflagellate zoospores. At present, four species have been formally described and included in this genus. They are *N. frontalis* (Braune) Heath (Heath *et al.*, 1983), *N. patriciarum* Orpin and Munn (1986), *N. joyonii* Breton *et al.* (1989) and *N. hurleyensis* Theodorou and Webb (Webb and Theodorou, 1991). Of the four species, *N. joyonii* has polycentric thallus and is more

appropriately placed in the genus *Orpinomyces* (Li *et al.*, 1991), recently erected by Barr *et al.*, (1989) to accomodate a polycentric species *O. bovis* Barr and Kudo with globose sporangia and polyflagellate zoospores. The other three species are monocentric, with mostly globose to ovoid sporangia, endogenous thallus development and polyflagellate zoospores of variable shapes. Since the morphological characteristics of these three species are somewhat similar, the species are distinguished by their zoospore ultrastructures, major fermentation products and carbohydrate nutrition.

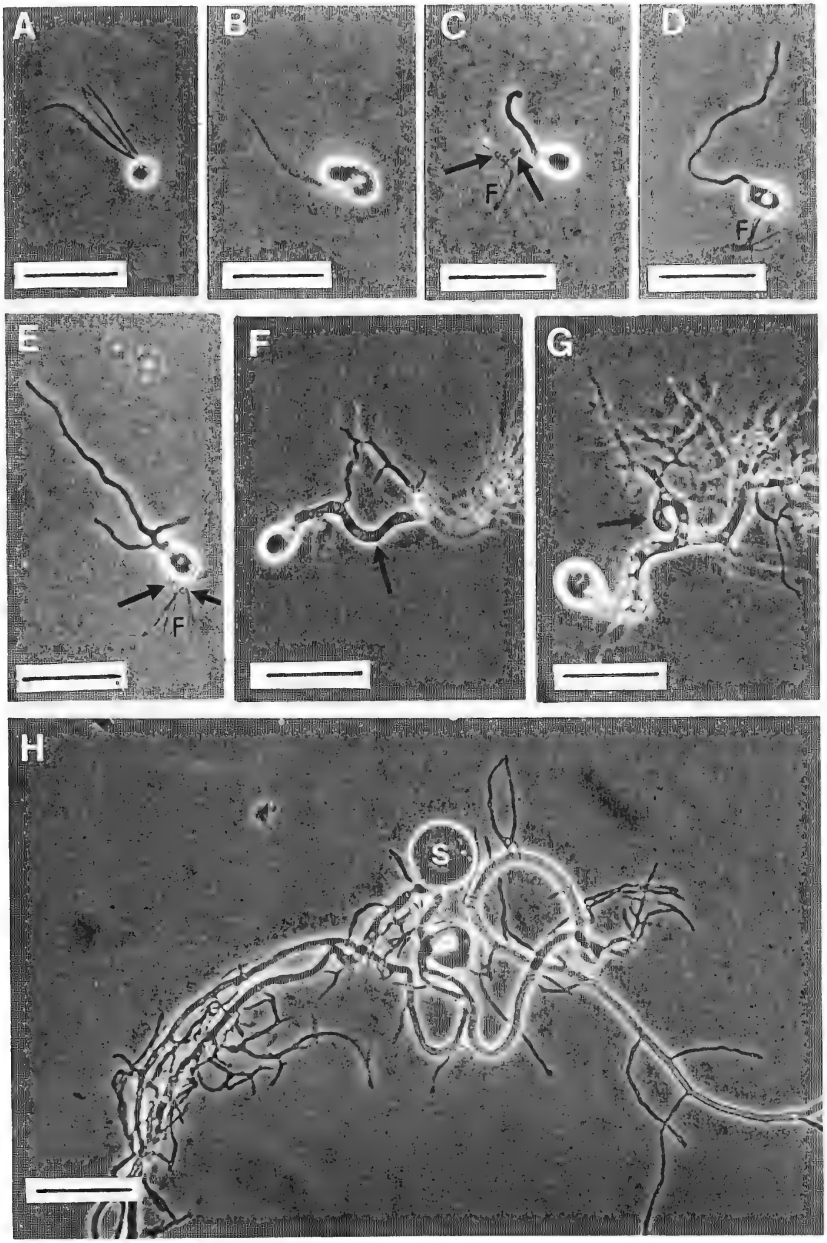
Recent isolations of fungi from the rumen of Kedah-Kelantan cattle (*Bos indicus*) fed guinea grass (*Panicum maximum) ad libitum* yielded an isolate (C15) belonging to the genus *Neocallimastix* but appears to be quite distinct from the four *Neocallimastix* species described. Apart from zoospore size and flagellation, the isolate is morphologically more similar to the monocentric, but monoflagellate species, *Piromyces communis* Gold (Gold *et al.*, 1988).

The media for culturing the isolates were glucose sloppy agar medium (Ho and Bauchop, 1991) and liquid medium (Barr *et al.*, 1989) with Whatman No. 1 filter paper, cellophane dialysis tubing, xylan or rice straw as carbohydrate source.

Neocallimastix variabilis Ho and Barr sp. nov. Figs. 1-10

Monocentricum. Sporangia ellipsoidalia, pyriformia, ovoidea, globosa vel irregularia, endogena aut plerumque exogena et sporangiophoris non ramosis variantibus longitudinibus insidentia. Rhizoidea ramosa atque extensa. Zoosporae reniformes vel ellipsoidales 8-14 x 12-20 μm, 8-17 flagella, 28-48 μm longa habentes. Anaerobium obligato in rumine bubalino.

Fig. 1. Endogenous development of *Neocallimastix variabilis*. A, a stationary polyflagellated zoospore; B, an actively motile reniform zoospore; C, a germinating zoospore. Note the shed flagella (F) with bead-like structures (arrow); D, elongation of germ tube. Note shed flagella (F); E, branching of germ tube to form rhizoids. Note shed flagella (F) with bead-like structures (arrow); F, main rhizoid begins to coil (arrow); G, main rhizoid forms a coil (arrow). Note the expansion of the zoospore cell to form the sporangium; H, an endogenous thallus with a young sporangium (S) and coiled main rhizoid forming many loops. Bar = 30 μm.


A
B
C
F
D
F
E
F
F
G
H
S

Monocentric. Sporangia ellipsoidal, pyriform, ovoid, globose or irregular, endogenous or frequently exogenous on unbranched sporangiophores of varying length. Rhizoids branched and extensive. Zoospores reniform to ellipsoidal 8-14 x 12-20 μm with 8-17 flagella, 28-48 μm long. Obligately anaerobic in the rumen of cattle.

In rumen contents of Kedah-Kelantan cattle (*Bos indicus*), Universiti Pertanian Malaysia, Serdang, Malaysia, 24 March 1992, Y.W. Ho and D.J.S. Barr, C15, (UPM) holotypus.

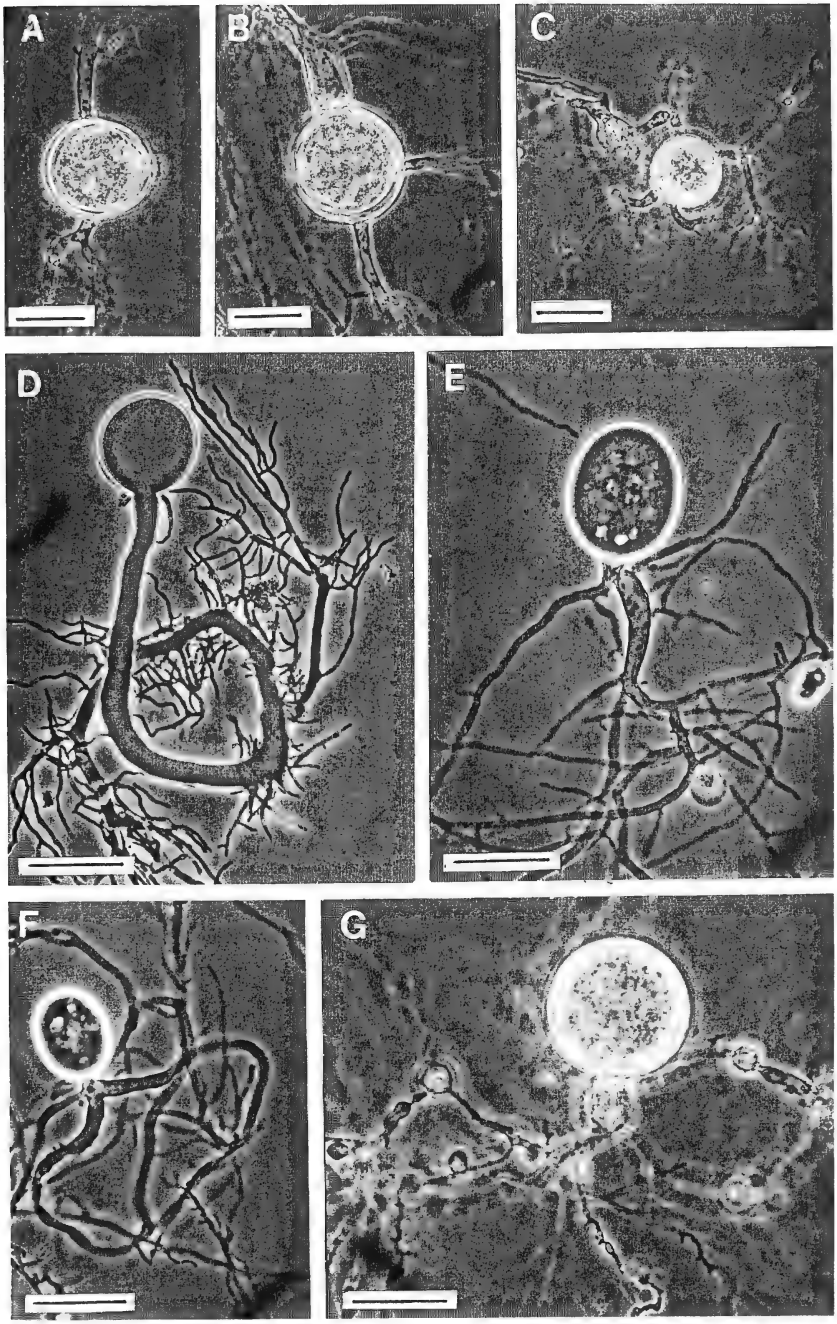
The zoospore of *N. variabilis* is irregular or globose (Fig. 1A), 7-14 μm in diameter when stationary but is somewhat reniform (Fig. 1B) or ellipsoidal, 8-14 μm wide x 12-20 μm long when actively motile. They are polyflagellated with 8-17 flagella, 28-48 μm long, posteriorly orientated. Flagella are shed when the zoospore encyst. Shed flagella frequently possess a bead-like structure (0.5 - 1.5 μm in diameter) at one end (Figs. 1C & E). Similar structure on shed flagella has been reported by Barr *et al.* (1989). They pointed out that such structures in other zoosporic fungi are associated with retraction. Shed flagella often remain clustered together next to the expanding zoospore cyst on young germlings (Figs. 1C-E).

Germination of zoospores produces two types of monocentric thallus development - endogenous and exogenous. Both types of thallus development commonly occur in all the five media used for culturing the isolates. In the endogenous type of thallus development, the encysted zoospore expands uniformly and produces a germ tube (Fig. 1C) which very quickly branches to form a network of rhizoids (Figs. 1D-H). Usually only one germ tube is formed, but occassionally, two to four germ tubes are produced resulting in more than one rhizoidal axes (Figs. 2A-C). The germ tube is narrow, 1-2 μm in diameter, and is quite even in diameter over its length without swellings or tightly constricted points (Figs. 1C & D).

The main rhizoid can be tubular and barely inflated below the neck (the point of contact between the rhizoid and sporangium) or bulbous, inflated and carrot-shaped (Figs. 2D & E). The diameter of

---

Fig. 2. Rhizoids of *Neocallimastix variabilis* with endogenous development. A-C, sporangia with two, three and four rhizoidal axes respectively; D, main rhizoid which is tubular below the neck; E, main rhizoid which is inflated below the neck and is carrot-like; F, two main rhizoids of equal size; G, rhizoids with swellings and constricted points. Bar = 30 μm.


A
B
C
D
E
F
G

the main rhizoids varies from 3.5 - 20 μm. Initially, the main rhizoid is rather straight but as it elongates, very often, it coils to form loops which are very distinct in older thallus (Figs. 1E-H & 2D). Smaller rhizoidal branches are usually not coiled. Coiled main rhizoids are more easily observed in thalli growing in glucose sloppy agar medium than in the other media. Similar coiled main rhizoids in two unnamed *Neocallimastix* isolates (No. 17 and 27 at Lethbridge, Canada) have been reported by Barr *et al.,* (1989). Occassionally, the main rhizoid, instead of remaining as a single main unit, branches at the neck to form two or more rhizoids of similar size (Fig. 2F).

Rhizoids are evenly to unevenly tapering, occassionaly with swellings and constricted points (Fig. 2G). The tips of the rhizoids are more or less straight with fine to moderately blunt ends (0.5 - 1.5 μm in diameter) (Figs. 3A & B). The rhizoidal system is extensive in length (more than three times the diameter of the sporangium) and it can be dense, consisting of a massive process of multibranched rhizoids at the neck (Fig. 3C), or open in density with sparse branches (Fig. 3D).

The sporangium develops from the expansion of the encysted zoospore (Figs. 1C - H). The port (opening in the neck) is open in immature sporangia but is demarcated by a septum in mature ones.

Sporangium shape is very variable. Small sporangia (8.5 - 20 μm diameter) are mostly globose or ovoid. Larger sporangia are often pyriform, ellipsoidal, ovoid or globose but occassionally, triangular, tubular or irregular (Figs. 2 & 4). Irregular sporangia are more common in thalli which grow together in a clump. Sporangium size is also highly variable, ranging from 8.5 to 170 μm in diameter. Many of the very large sporangia, >100 μm in diameter, do not form or liberate zoospores and appear moribund. This may be due to the thick sporangium wall which prevents the normal functioning of the release mechanism (Barr, 1984). Occassionally, zoospores germinate inside the sporangium.

Small, mature sporangia (8.5 - 20 μm in diameter) produce one to two zoospores (Fig. 5A) but larger sporangia produce many zoospores (Fig. 5B) whose number is difficult to ascertain accurately under light microscopy. Zoospore release is through a breakage in the apical portion of the sporangial wall (Fig. 5B). Dissolution and collapse of the whole sporangial wall follow rapidly (Fig. 5C). The sporangial wall (clearly seen after zoospore release) is smooth.

Endogenous sporangia of *N.variabilis* are easily detached from the rhizoidal system. The sporangia break off at the neck (Fig. 5D) and are scattered in the medium. We have frequently observed

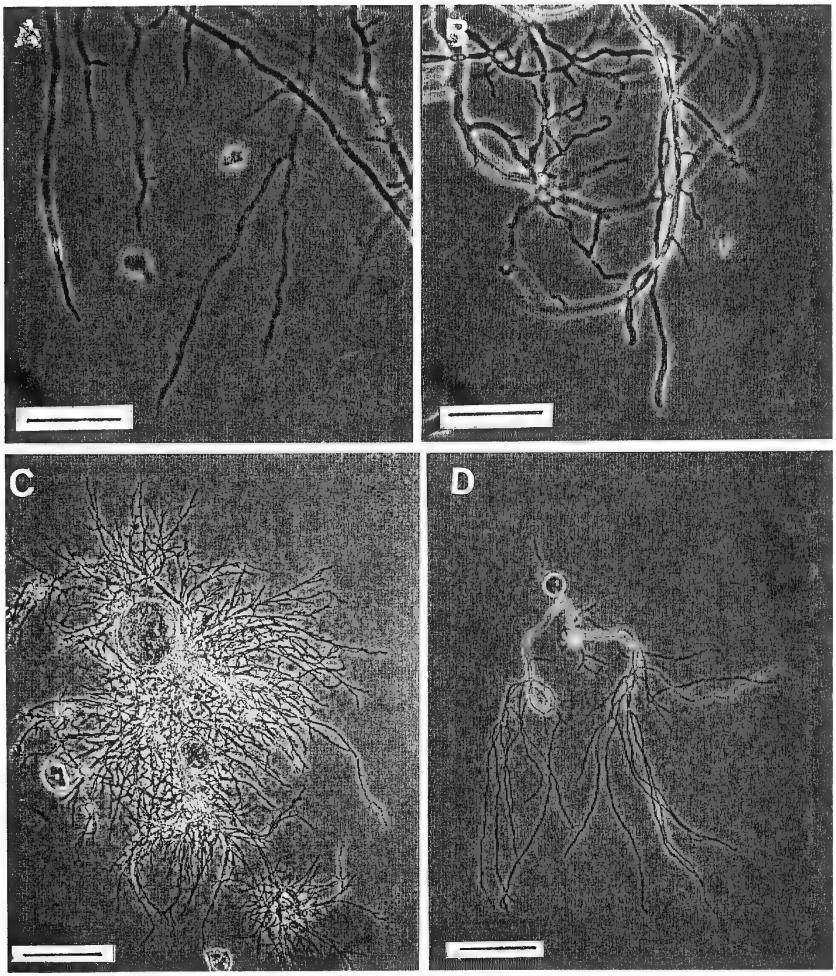


Fig. 3. Rhizoidal systems of *Neocallimastix variabilis* with endogenous development. A & B, rhizoids with fine and moderately blunt ends respectively. Bar = 30 μm; C & D, dense and sparse or open rhizoidal systems respectively. Bar = 100 μm.

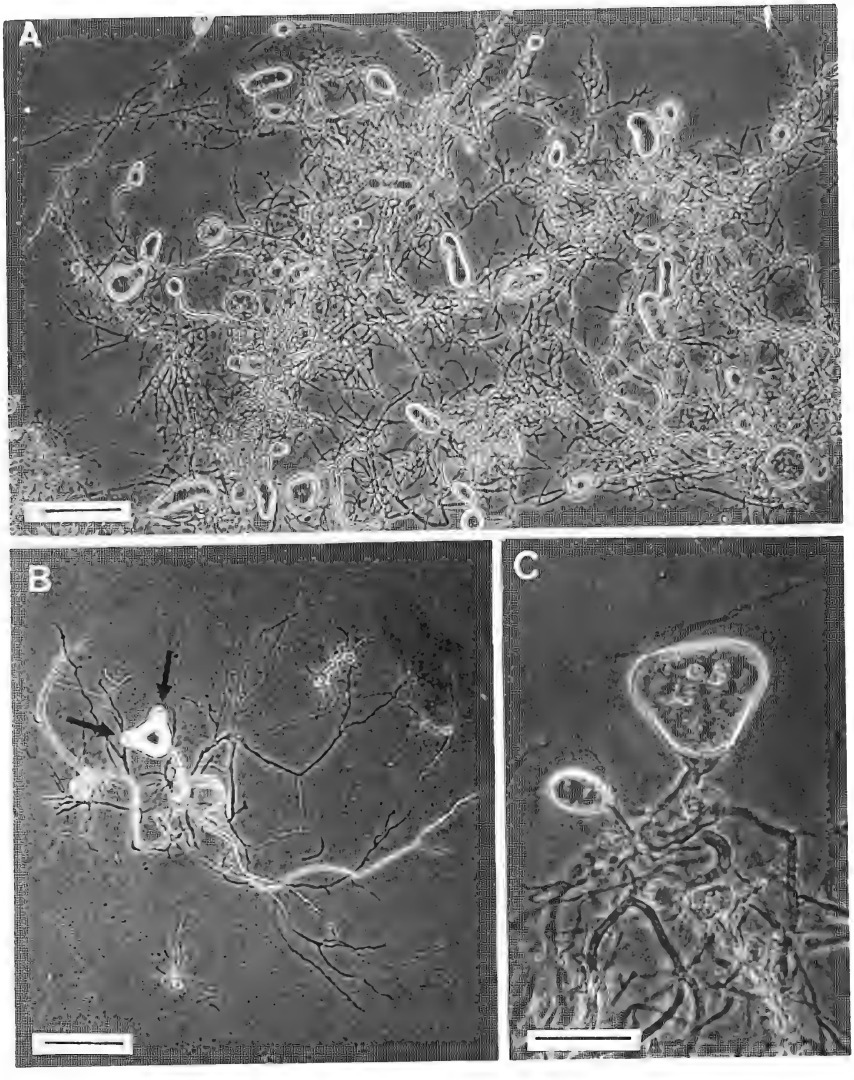


Fig. 4. Sporangium shape of *Neocallimastix variabilis* with endogenous development. A, a mass of thalli with sporangia of variable shapes. Bar = 100 μm; B, sporangium with knob-like structures (arrows). Bar = 100 μm; C, triangular-shaped sporangium. Bar = 30 μm.

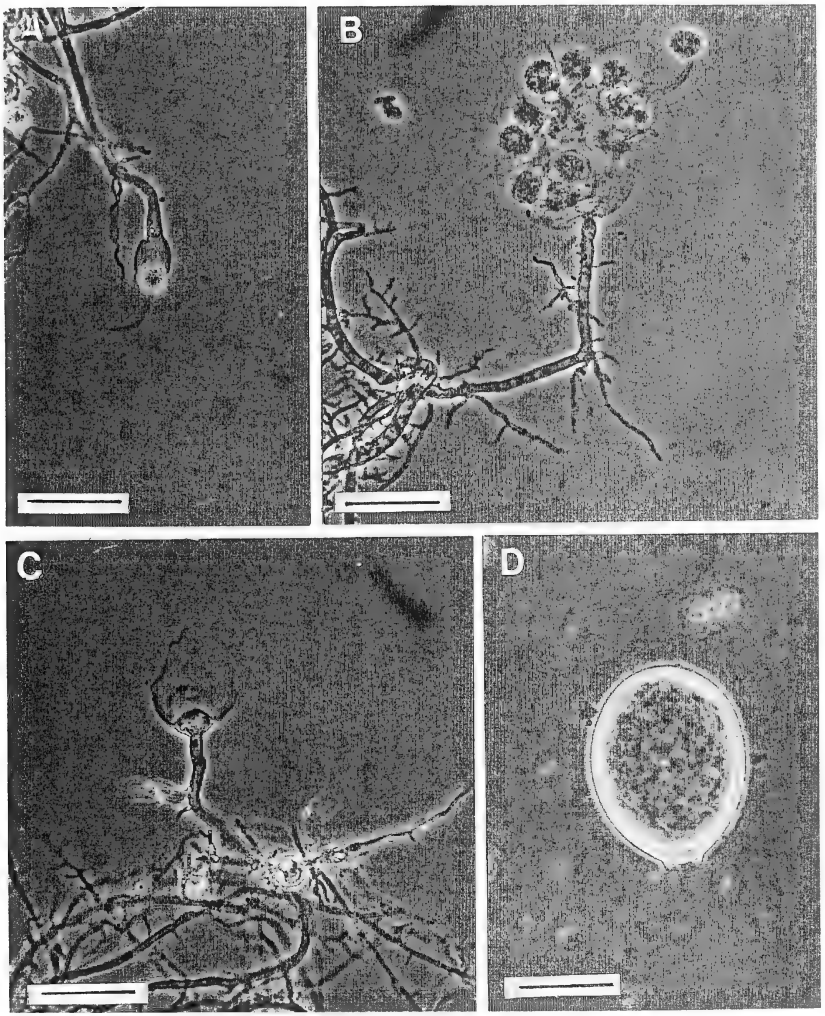


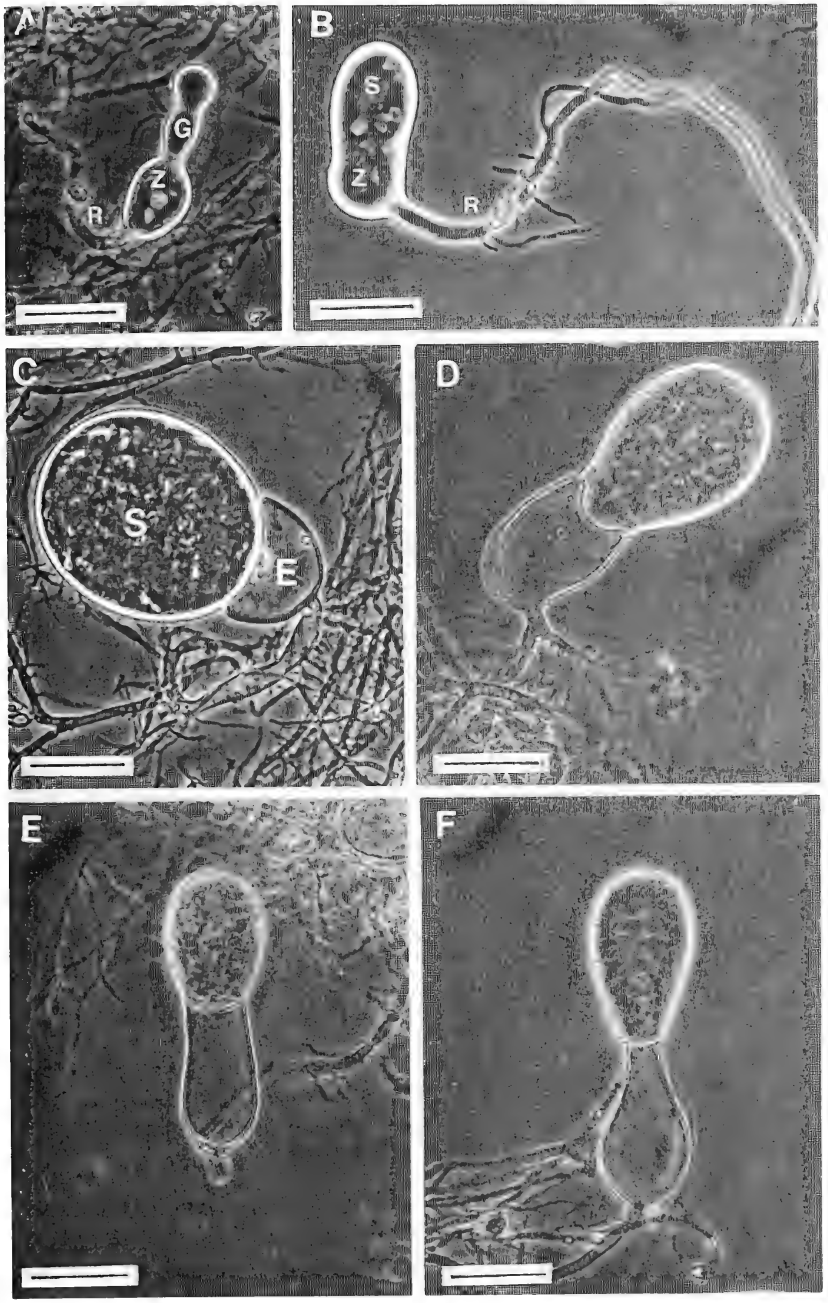
Fig. 5. Mature sporangia of *Neocallimastix variabilis* with endogenous development. A, a small sporangium releasing one zoospore through a rupture in the apical portion; B, a large sporangium with many zoospores; C, dissolution and collapse of the whole sporangial wall following release of zoospores; D, shed sporangium which is broken off at the neck. Bar = 30 μm.

detached sporangia in the rumen contents of cattle, buffalo, goats and sheep. Barr *et al.,* (1989) suggested that detached sporangia may be a means of dispersal.

In the exogenous type of thallus development, the encysted zoospore expands and produces a germ tube which develops into a rhizoidal system at one side and a broader tubular outgrowth which gives rise to a sporangium at its apex at the opposite side (Fig. 6A). Barr *et al.* (1989) referred to the tubular outgrowth as the sporangiophore. The sporangiophore is unbranched and varies greatly in length. It can be short, bulbous or cup-shaped, formed mainly from the zoospore cyst (Figs. 6B-F), or it can be long and filamentous with a zoospore cyst at one end and a sporangium at the other (Figs. 7A-D), or it can be intermediate between the short and long sporangiophores, possessing a bulbous zoospore cyst and a moderately long but broad sporangiophore (Figs. 8A & B).

The short, bulbous, sporangiophore appears like an egg-cup with the sporangium appearing like an egg. This type of sporangiophore is henceforth referred to as egg-cup form (Fig. 6C). The progressive development of the egg-cup sporangiophore is shown in Figs. 6B-F. The encysted zoospore germinates to produce rhizoids as in the endogenous type of development, but once the rhizoidal system is established, the zoospore cyst elongates at the opposite end to form a sporangium (Fig. 6B). In the initial stages of development, the sporangium is continuous with the zoospore cyst (Fig. 6B) but at maturity it is demarcated by a basal septum (Fig. 6C). At this stage, most of the protoplasmic contents are aggregated in the sporangium and the zoospore cyst appears empty and resembles an egg-cup. The shape of the egg-cup sporangiophore varies from very short and cup-like to broadly tubular (Figs. 6D & E) and pyriform (Fig. 6F). The size of the egg-cup sporangiophores varies from 14x14 μm to 26x60 μm (diameter x length).

Fig. 6. Formation of egg-cup sporangiophore in the exogenous development of *Neocallimastix variabilis.* A, a zoospore cyst (Z) producing a broad germ tube (G) at one end and a rhizoidal system (R) at the other; B, initial stage of development of an egg-cup sporangiophore. The sporangium (S) is open to the zoospore cyst (Z). Note the developed rhizoidal system (R); C, a mature sporangium (S) with an egg-cup sporangiophore (E); D, a tubular egg-cup sporangiophore; E, egg-cup sporangiophore with a slight constriction at the neck; F, egg-cup sporangiophore with a narrow neck. Bar = 30 μm.


A
G
Z
R
B
S
Z
R
C
S
E
D
E
F

In the development of the long sporangiophore, the encysted zoospore elongates to produce a long slender tube which terminates in a sporangium (Figs. 7A-D). The length of most of these sporangiophores varies from 100-800 μm long but in one extreme case, the sporangiophore was 1064 μm long. The diameter of sporangiophore varies from 5.5 - 14 μm. In *N. variabilis*, even very long sporangiophores develop sporangia capable of differentiating and releasing zoospores as empty sporangia on these long sporangiophores are frequently observed. Very long sporangiophores (>250 μm) in *Piromyces communis* have been reported to abort and fail to develop sporangia (Barr *et al.*, 1989).

The size of the sporangiophore which is intermediate between the egg-cup sporangiophore and the long sporangiophore is 10-25 μm wide x 35-110 μm long. The zoospore cyst and the sporangiophore are usually much larger than those of the long sporangiophore (Figs. 8A & B).

The shape of exogenously formed sporangia is very variable. Small sporangia are globose or ovoid but larger ones are pyriform, globose, broadly ovoid, broadly ellipsoidal or irregular (Figs. 8C & D). The size of the sporangium also varies greatly, 17-126 μm wide x 34-170 μm long. Similar to the endogenously formed sporangia, the exogenous sporangia are easily detached, but they usually break off with the whole or part of the sporangiophore attached to them (Fig. 9A).

Zoospore release is through a rupture in the apical portion of the sporangial wall (Figs. 9B & C, 10B). Collapse and dissolution of the sporangial wall takes place rapidly after zoospore release (9D) but the sporangiophores, both long and egg-cup form, are more persistent (Figs. 10C & D). Sporangial wall, as observed in empty sporangium, is smooth.

The rhizoids and the rhizoidal system in the exogenous type of development are very similar to those of the endogenous type of development except that coils in the main rhizoid are less distinct.

Although the exogenous type of development occurs in all the culture media used, it occurs more often in media with filter paper, rice straw, dialysis tubing or xylan. Such growth development is also common in cultures which are three to four days old.

N. variabilis is included in the genus *Neocallimastix* because the thallus is monocentric and the zoospores are polyflagellate. However, *N. variabilis* is morphologically similar to the monocentric,

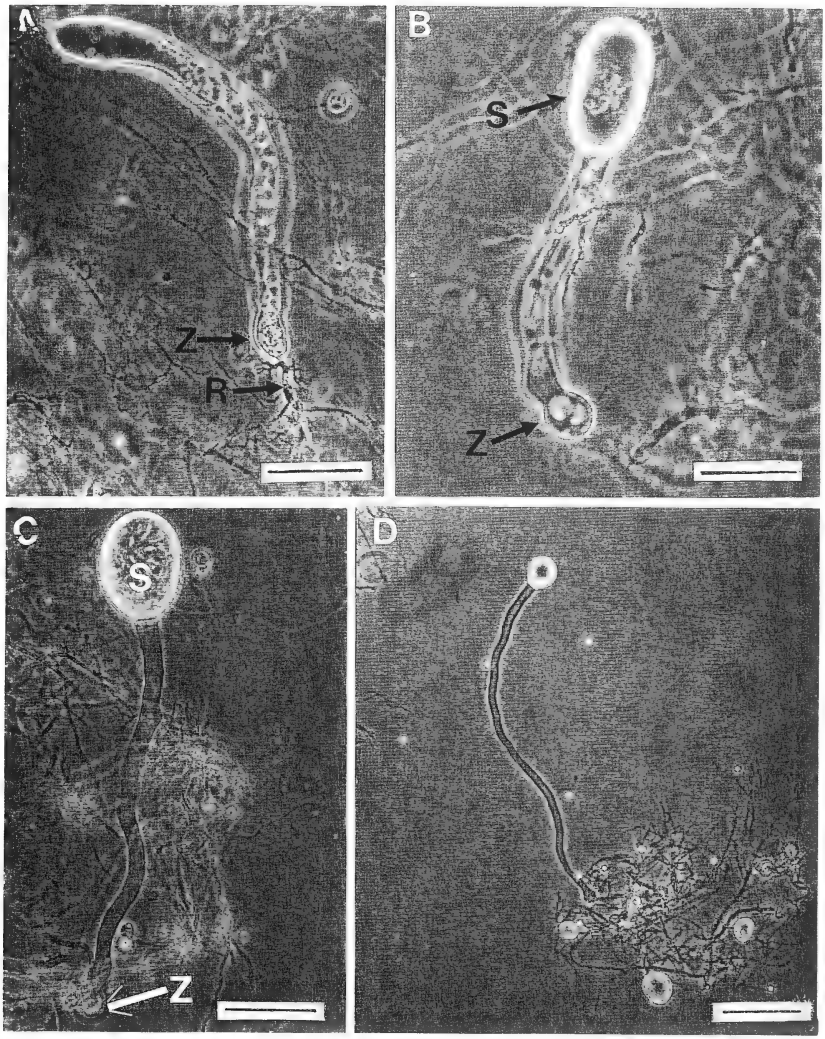


Fig. 7. Formation of long sporongiophore in the exogenous development of *Neocallimastix variabilis*. A, zoospore cyst (Z) produces a rhizoidal system (R) at one end and a long filamentous tube at the other. Bar = 30 μm; B, a young sporangium (S) at the apex of the tube. Z is the zoospore cyst. Bar = 30 μm; C, a mature sporangium (S) with a basal septum. Note the long, slender sporangiophore and zoospore cyst (Z) at the base. Bar = 30 μm; D, an exogenously formed sporangium with a very long sporangiophore of about 700 μm long. Bar = 100 μm.

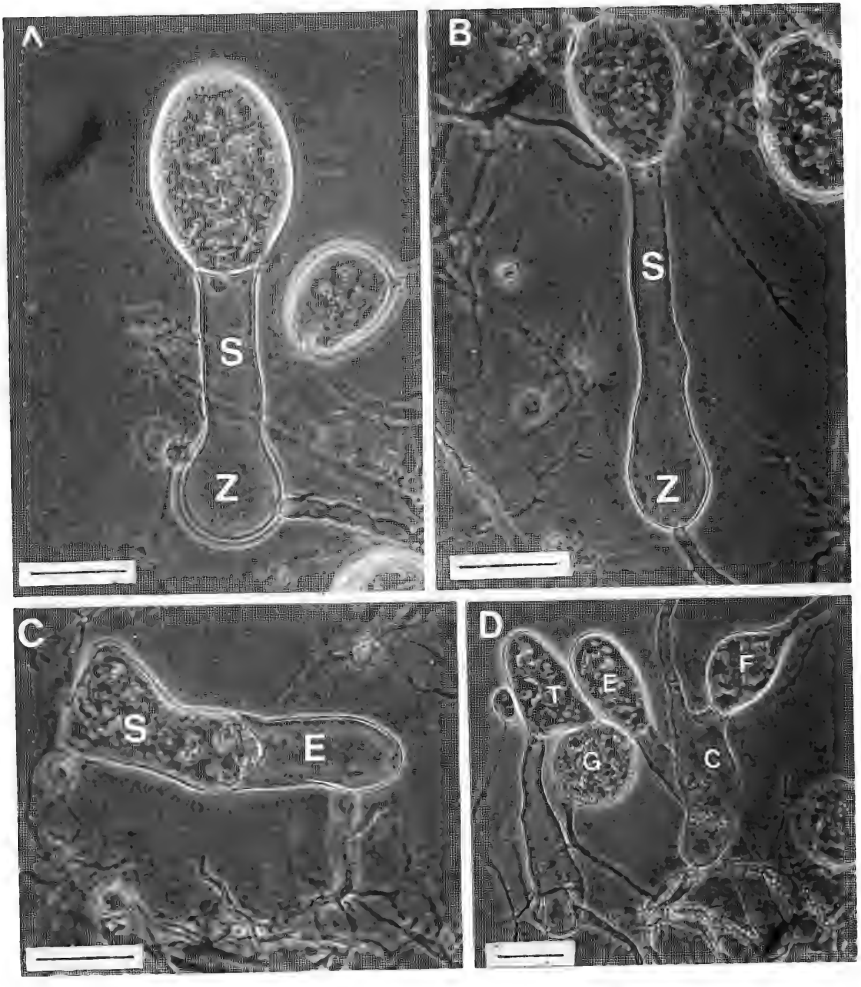


Fig. 8. Sporangiophores of "intermediate" lengths and sporangia of *Neocallimastix variabilis* with exogenous development. A, zoospore cyst (Z) which develops a broad sporangiophore(S) (about 25 μm long) at one end and a rhizoid at the other; B, zoospore cyst (Z) which produces a longer (about 400 μm) and narrower sporangiophore(S) at one end and a rhizoid at the other; C, An irregularly-shaped sporangium (S), with an egg-cup sporangiophore (E); D, sporangia of variable shapes - globose (G), triangular (T), ellipsoidal (E) and fusiform (F) with an egg-cup sporangiophore (C) and two rhizoidal systems. Bar = 30 μm.

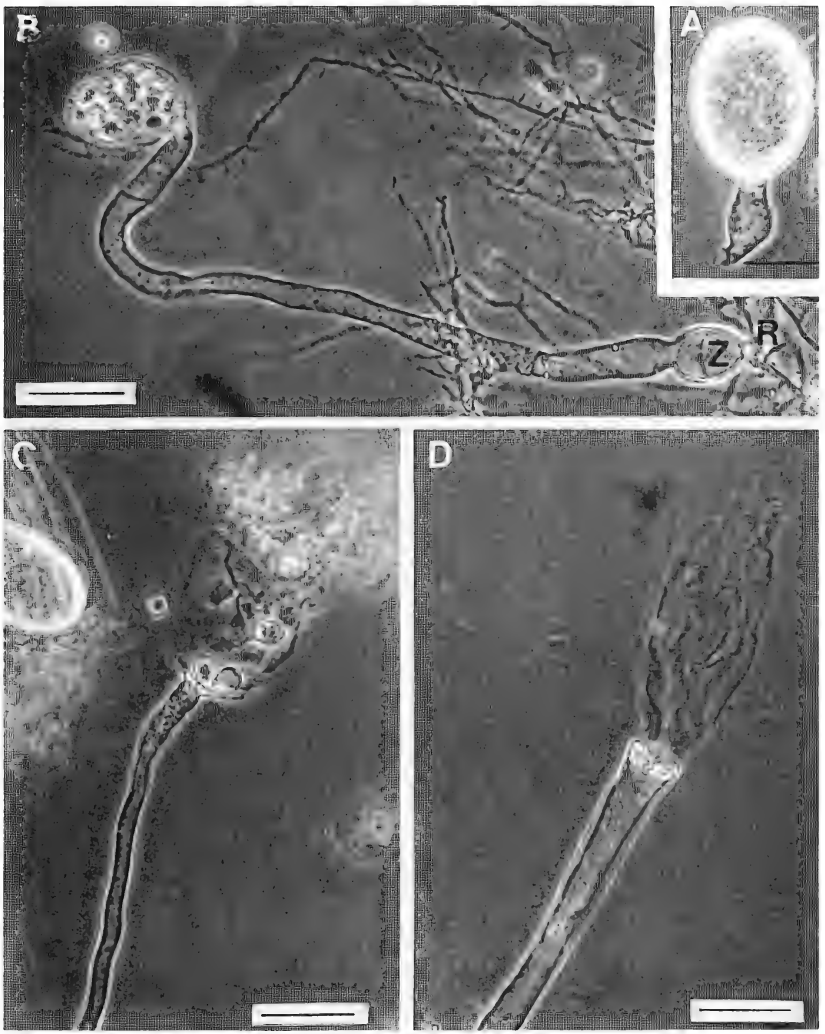


Fig. 9. Sporangia of *Neocallimastix variabilis* with exogenous development. A, a shed sporangium with a short sporangiophore attached; B, a mature sporangium (with zoospores) on a long sporangiophore. Z is the zoospore cyst and R, the rhizoidal system; C, a sporangium on a long sporangiophore liberating zoospores through an apical rupture; D, collapse and dissolution of a sporangium after the release of the zoospores. Bar = 30 μm.

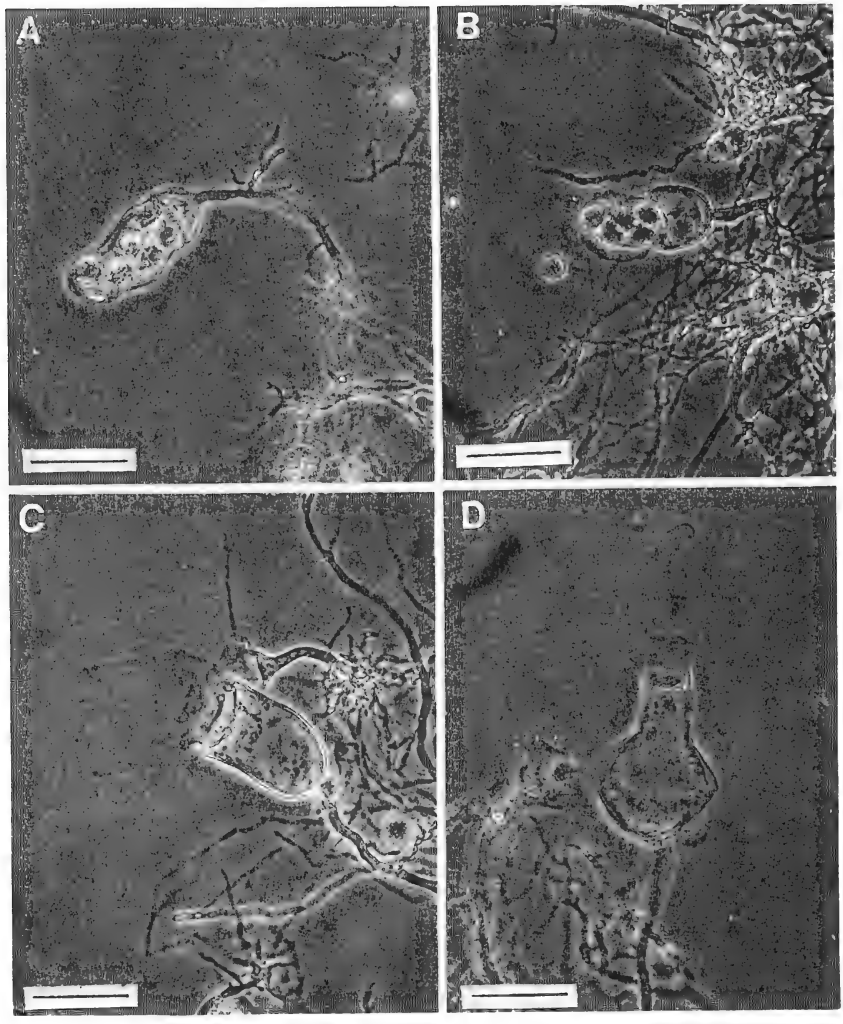


Fig. 10. Sporangia of *Neocallimastix variabilis* with exogenous development. A, a mature sporangium with zoospores. Note the short egg-cup sporangiophore; B, a sporangium on an egg-cup sporangiophore liberating zoospores through an apical rupture in the sporangium; C, dissolution of sporangial wall after the release of zoospores. The wall of the tubular egg-cup sporangiophore is more persistent and remains intact; D, an intact flask-shaped egg-cup sporangiophore with disintegrating sporangial wall. Bar = 30 μm.

monoflagellate species, *Piromyces communis*, in its sporangium shape, the fragility of the sporangium (breaking off at the neck or with the sporangiophore) and in having both endogenous and exogenous types of development. These characteristics separate *N. variabilis* distinctly from the other *Neocallimastix* species described and thus require it to be assigned to a new species.

Other isolates examined: Four other isolates obtained from the rumen contents of Kedah-Kelantan cattle and two isolates from swamp buffalo *(Bubalus bubalis)* at Universiti Pertanian Malaysia, Serdang, Malaysia, February - May, 1992, were also examined and their morphological characteristics conform to the above description.

ACKNOWLEDGEMENTS

The authors thank Dr. J. Bisset for kindly providing the Latin translation of the diagnosis, and Professor A. Nawawi for reviewing the manuscript.

REFERENCES

Barr, D.J.S. (1984). The classification of *Spizellomyces, Gaertneriomyces, Triparticalar* and *Kochiomyces* (Spizellomycetales, Chytridiomycetes). *Canadian Journal of Botany* 62, 1171-1201.

Barr, D.J.S., Kudo, H., Jakober, K.D. & Cheng, K.-J. (1989). Morphology and development of rumen fungi: *Neocallimastix* sp., *Piromyces communis* and *Orpinomyces bovis* gen. nov., sp. nov. *Canadian Journal of Botany* 67, 2815-2824.

Breton, A., Bernalier, A., Bonnemoy, F., Fonty, G., Gaillard, B. & Gouet, P. (1989). Morphological and metabolic characterization of a new species of strictly anaerobic rumen fungus: *Neocallimastix joyonii*. *FEMS Microbiology Letters* 58, 309-314.

Gold, J.J., Heath, I.B. & Bauchop, T. (1988). Ultrastructural description of a new chytrid genus of caecum anaerobe, *Caecomyces equi* gen. nov., sp. nov., assigned to the Neocallimasticaceae. *BioSystems* 21, 403-415.

Heath, I.B., Bauchop, T. & Skipp, R.A. (1983). Assignment of the rumen anaerobe *Neocallimastix frontalis* to the Spizellomycetales (Chytridiomycetes) on the basis of its polyflagellate zoospore ultrastructure. *Canadian Journal of Botany* 61, 295-307.

Ho, Y.W. & Bauchop, T. (1991). Morphology of three polycentric rumen fungi and description of a procedure for the induction of zoosporogenesis and release of zoospores in cultures. *Journal of General Microbiology* 137, 213-217.

Li, J., Heath, I.B. & Cheng, K -J. (1991). The development and zoospore ultrastructure of a polycentric chytridiomycete gut fungus, *Orpinomyces joyonii* comb. nov. *Canadian Journal of Botany* 69, 580-589.

Orpin, C.G. & Munn, N.A. (1986). *Neocallimastix patriciarum* sp. nov., a new member of the *Neocallimasticaceae* inhabiting the rumen of sheep. *Transactions of the British Mycological Society* 86, 178-181.

Webb, J. & Theodorou, M.K. (1991). *Neocallimastix hurleyensis* sp. nov., an anaerobic fungus from the ovine rumen. *Canadian Journal of Botany* 69, 1220-1224.

MYCOTAXON

Volume XLVI, pp. 259-261 January-March 1993

ENDOCONOSPORA INDICA SPEC. NOV.

U. Braun

Martin-Luther-Universität, F.B. Biologie,
Institut für Geobotanik und Botanischer Garten,
Neuwerk 21, D-O-4020 Halle/S., Germany

V. B. Hosagoudar

Botanical Survey of India, Southern Circle,
Coimbatore - 641003
India

Endoconospora indica spec. nov.

Leaf spots absent, conidiomata (sporodochia) amphigenous, mainly hypophyllous, whitish, punctiform, often confluent, mycelium internal, hyaline, septate, branched, ca. 1.5-4 µm wide, forming well developed stromata, substomatal to intraepidermal, colourless, ca. 40-90 µm diam. Conidiophores in dense, rich fascicles, arising from stromata, through stomata or erumpent through the cuticle, 10-30 x 2-5 µm, simple, straight to flexuous, continuous, hyaline, smooth, subcylindric or somewhat attenuated or enlarged towards the tip, occasionally somewhat constricted below the apex, conidiogenous cells enteroblastic, monophialidic. Conidia ellipsoid, ovoid, subcylindric, occasionally somewhat curved, aseptate, 6-16 x 2-4 µm, hyaline, smooth, apex obtuse, base rounded, conidia sometimes adhering to each other. Fig. 1

Maculae nullae. Conidiomata (sporodochia) amphigena, saepe hypophylla, albida, punctiformes, saepe confluentes. Mycelium immersum: hyphae incolores, hyalinae, septatae, ramosae, ca. 1.5-4 µm latae. Stromata substomatalia vel intraepidermalia, hyalina, ca. 40-90 µm diam. Conidiophora numerosa, dense fasciculata, per stoma emergentia vel erumpentia, 10-30 x 2-5 µm, simplicia, recta vel flexuosa, continua, hyalina, laevia, subcylindrica, apicem versus interdum leniter attenuata vel incrassata, interdum superne leniter constricta. Cellulae conidiogenae enteroblasticae, monophialidicae. Conidia ellipsoidea, ovoidea, subcylindrica, interdum leniter curvata, continua, 6-16 x 2-4 µm, hyalina, laevia, apice obtusa, basi rotundata.

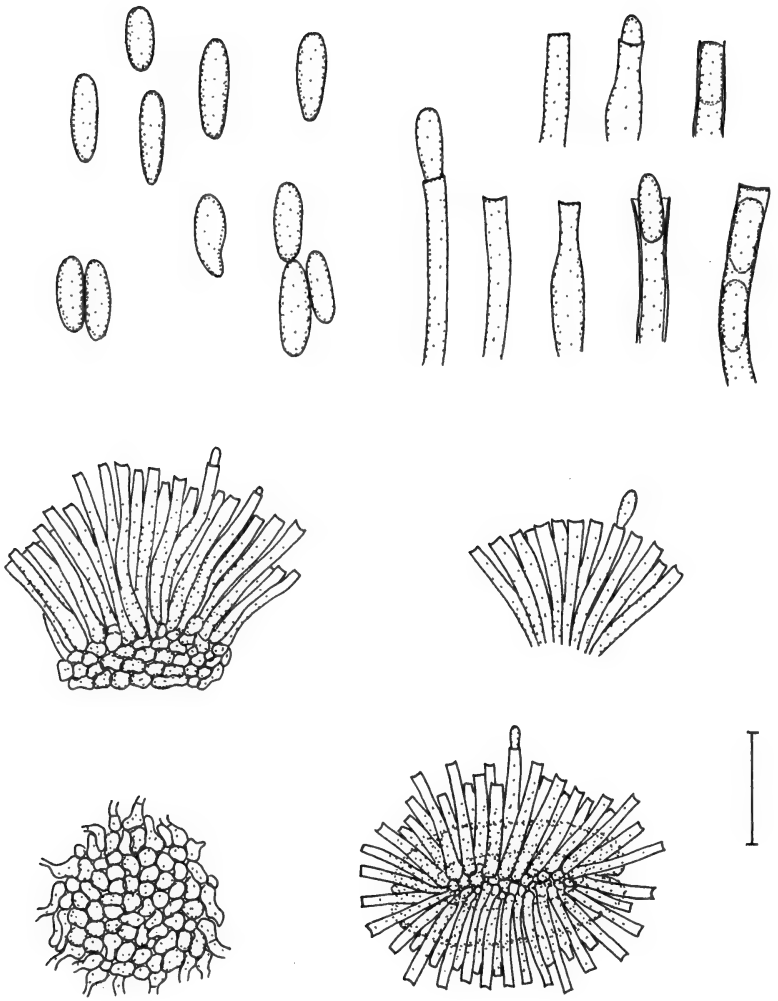


Fig. 1. *Endoconospora indica* spec. nov., conidia, conidiogenous cells, conidiomata, fascicles, stroma. Scale 20 µm. U. Braun del.

Holotypus: on *Leucaena latisiliqua* (L.) Gill. (Fabaceae), India, Coimbatore, 10-12-1991, V. B. Hosagoudar (MH).

Isotypus: HAL.

Endoconospora Gjaerum (1971) is the only appropriate genus for the present species. *E. indica* is a phytoparasitic fungus, well characterized by sporodochial conidiomata, monophialidic conidiogenous cells and one-celled conidia. All structures are hyaline. The European *E. cerastii*, type species of *Endoconospora*, differs from the new species by larger conical conidia.

Literature

Gjaerum, H. B. (1971): Notes on Norwegian fungi. 7-9. Norw. J. Bot. 18: 109-112.

MYCOTAXON

Volume XLVI, pp. 263-274 January-March 1993

PHYTOPARASITIC HYPHOMYCETES FROM UTAH (USA)

U. BRAUN

Martin-Luther-Universität, F.B. Biologie,
Institut für Geobotanik und Botanischer Garten,
Neuwerk 21, D-O-4020 Halle/S., Germany

C. T. ROGERSON

The New York Botanical Garden,
Bronx, New York 10458-5126
USA

The present paper contains descriptions of 6 new phytoparasitic hyphomycetes, i.e. *Passalora mertensiae* spec. nov., *Phaeoramularia collomiae* spec. nov., *Pseudocercospora geraniacearum* spec. nov., *Ramularia achilleae-millefolii* spec. nov., *R. arvensis* var. *cercosporelloides* var. nov., *R. epipactidis* spec. nov., *R. maculicola* spec. nov. and *Stigmina collinsiae* spec. nov. The new combinations *Phaeoramularia coalescens* (J. J. Davis) comb. nov. and *Pseudocercospora omphacodes* (Ell. & Holw.) comb. nov. are introduced. 23 additional species on 26 host species are recorded from Utah.

(1) *Passalora mertensiae* U. Braun & C. T. Rogerson spec. nov.

Leaf spots amphigenous, irregularly shaped, large, ca. 5-25 mm diam., pale to dark brown, greyish brown, margin indefinite, sometimes large leaf segments brown, necrotic, mycelium internal, brownish, forming small to large hyphal aggregations in the epidermal cells, composed of swollen hyphae, up to 8 µm wide, brown. Conidiophores solitary or in small, loose groups, erumpent through the cuticle, arising from hyphal aggregations, short and stout, 6-25 x (5-) 6-8 (-10) µm, subcylindric to conical, simple, aseptate, smooth, subhyaline, yellowish, olivaceous to pale brown, conidial scars conspicuous, hardly thickened, but somewhat darkened. Conidia solitary, subcylindric, obclavate, ca. 50-75 x 3.5-7 µm, 1-3-septate, subhyaline to pale greenish, olivaceous, apex obtuse, base truncate, hila hardly thickened, but somewhat darkened. Fig 1

Maculae amphigenae, irregulares, magnae, ca. 5-25 mm diam., brunneae. Mycelium immersum. Stroma nullum vel parvum, ex hyphis brunneis, inflatis (-8 µm) compositum. Conidiophora solitaria vel subfasciculata, erumpentia, 6-25 x (5-) 6-8 (-10) µm, subcylindrica, conica, simplicia, laevia, continua, subhyalina, flava, olivacea vel pallide brunnea. Cicatrices conidiales conspicuae, leniter incrassatae, obscurae. Conidia solitaria, subcylindrica, obclavata, ca. 50-75 x 3.5-7 µm, 1-3 septata, subhyalina, viridula, pallide olivacea, apice obtusa, basi truncata, leniter incrassata.

Holotypus: on *Mertensia ciliata* (E. James ex Torr.) G. Don. (Boraginaceae), USA, Wasatch Co., Wasatch Nat. Forest, Utah, 8-8-1983, Rogerson 83-137 (NY). Isotypus: HAL.

The conidia are only 1-3-septate and the conidial scars are hardly thickened (*Passalora* type, cf. Deighton 1990, Braun 1992). Therefore, this species must be referred to *Passalora* (incl. *Cercosporidium*).

(2) *Phaeoramularia coalescens* (J. J. Davis) U. Braun & C. T. Rogerson comb. nov.

Bas.: *Cercospora coalescens* J. J. Davis, Trans. Wis. Acad. Sci. 15, p.779 (1907), type - on *Ribes bracteosum* Dougl., USA, Portland, Ore., 12-7-1905, J. J. Davis (WIS).

Syn.: *Ramularia coalescens* (J. J. Davis) Piroz., Fungi Canad. 23 (1974).

On *Ribes inerme* (*R. divaricatum* var. *inerme*), USA, Morgan Co., west of Milton, Utah, 29-8-1986, Rogerson 86-128 (NY, HAL).

C. coalescens is a common parasite on various *Ribes* species. On account of the coloured stromata and conidiophores (yellowish, greenish to olivaceous), this species must be placed in *Phaeoramularia*. The collection on *Ribes inerme* is characterized as follows: conidiophores in dense, rich fascicles, through stomata, 10-70 x 2-5 µm, yellowish, greenish to olivaceous, conidia catenate, ellipsoid, subcylindric, 15-40 x (2-) 2.5-5 (-6) µm, 0-1-septate, smooth to faintly verruculose, subhyaline to pale greenish, occasionally with 1-2 long germ tubes.

(3) *Phaeoramularia collomiae* U. Braun & C. T. Rogerson spec. nov.

Leaf spots amphigenous, yellowish, ochraceous to brown, irregular, diffuse, ca. 2-15 x 1-5 mm, caespituli hypophyllous, brownish, punctiform to confluent, mycelium internal, subhyaline to olivaceous, septate, branched, forming well developed substomatal stromata, ca. 20-80 µm diam., yellowish brown, large stromata often rupturing the stomata, somewhat erumpent. Conidiophores in dense, rich fascicles,

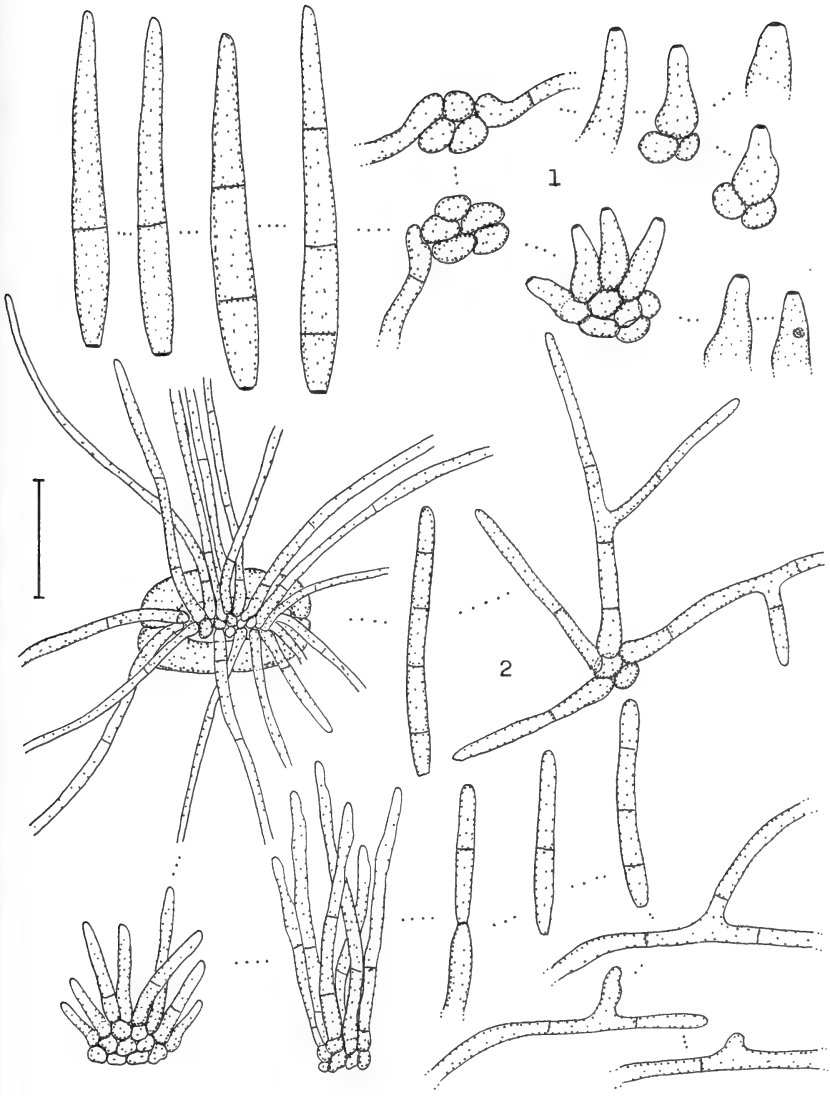


Fig. 1-2: Mycelium, stromata, conidiophores, conidia of (1) *Passalora mertensiae* spec. nov., (2) *Pseudocercospora geraniacearum* spec. nov. Scale 20 µm. U. Braun del.

arising from stromata, through stomata, ca. 10-40 x 3-6 µm, straight, subcylindric to somewhat geniculate-sinuous, continuous or with a single septum, smooth, pale olivaceous to yellowish brown, conidial scars conspicuous, slightly thickened. Conidia catenate, ellipsoid, ovoid, cylindric, occasionally subclavate, 15-50 x (4-) 5-7 (-8) µm, 0-3-septate, subhyaline, pale olivaceous to faintly yellowish brown, smooth. Fig. 7

Maculae amphigenae, flavidae, ochraceae vel brunneae, irregulares, diffusae, ca. 2-15 x 1-5 µm. Caespituli hypophylli, punctiformes vel confluentes. Mycelium immersum: hyphae subhyalinae, olivaceae, septatae, ramosae. Stromata substomatalia, ca. 20-80 µm diam., flavido-brunnea, interdum leniter erumpentia. Conidiophora dense fasciculata, per stoma emergentia, ca. 10-40 x 3-6 µm, recta, subcylindrica vel leniter geniculata-sinuosa, 0-1 septata, laevia, pallide olivacea vel flavido-brunnea. Cicatrices conidiales conspicuae, leniter incrassatae. Conidia catenata, ellipsoidea, ovoidea, cylindrica, interdum subclavata, 15-50 x (4-) 5-7 (-8) µm, 0-3 septata, subhyalina, pallide olivacea, pallidissime flavido-brunnea, laevia.

Holotypus: on *Collomia linearis* Nutt. (Polemoniaceae), USA, field near Wolf Creek, Eden, Weber Co., Utah, 3-6-1971, Rogerson (NY).

This new species on *Collomia* is characterized by catenate conidia and coloured stromata and conidiophores. Hence, it must be placed in *Phaeoramularia*.

(4) *Pseudocercospora geraniacearum* U. Braun & C. T. Rogerson spec. nov.

Leaf spots amphigenous, angular-irregular, ca. 2-20 mm diam., sometimes vein-limited, ochraceous to brown, margin indefinite or darker brown to purplish, narrow, caespituli amphigenous, brown, punctiform to dense. Primary mycelium internal, forming substomatal stromata, ca. 10-25 µm diam., brown, often somewhat erumpent. Conidiophores in small to moderately rich fascicles, arising through stomata, from substomatal stromata, 10-100 x 1.5-3.5 µm, simple, occasionally branched, subcylindric to slightly geniculate-sinuous, septate, smooth, subhyaline to olivaceous brown, conidial scars inconspicuous, unthickened, conidiophores erect to horizontally spread, creeping conidiophores gradually developing into superficial, secondary mycelium, 1.5-3.5 µm wide, subhyaline to olivaceous, branched, smooth, occasionally with short lateral branches (secondary conidiophores). Conidia solitary, subcylindric, ca. 30-60 x 3-4.5 µm, 1-4-septate, subhyaline to pale olivaceous, smooth, apex obtuse, base truncate, unthickened. Fig. 2

Maculae amphigenae, irregulariter angulatae, ca. 2-20 mm

diam., interdum per venas limitatae, ochraceae, brunneae, sine margine distincto vel margine angusti atrobrunneo vel purpureo cinctae. Caespituli amphigeni, brunnei. Mycelium primarium immersum. Stromata substomatalia, ca. 10-25 µm diam., brunnea, interdum leniter erumpentia. Conidiophora primaria fasciculata, per stoma emergentia, 10-100 x 1.5-3.5 µm, simplicia, interdum ramosa, subcylindrica, leniter geniculata-sinuosa, laevia, subhyalina vel olivaceo-brunnea. Cicatrices conidiales inconspicuae. Mycelium secundarium superficiale: hyphae 1.5-3.5 µm latae, subhyalinae vel olivaceae, ramosae, laeves, conidiophora secundaria brevia, lateraliter gerentes. Conidia solitaria, subcylindrica, ca. 30-60 x 3-4.5 µm, 1-4 septata, subhyalina vel pallide olivacea, laevia, apice obtusa, basi truncata, non incrassata.

Holotypus: on *Geranium richardsonii* Fisch. & Trautv. (Geraniaceae), USA, Weber Co., North Fork County Park, Utah, 2-8-1988, Rogerson 88-122 (NY). Isotypus: HAL.

Pseudocercospora geraniicola U. Braun (syn.: *Cylindrosporium geranii* Ell. & Ev., *Cercospora geranii* Kellerm. & Sw.) differs from *P. geraniacearum* by shorter conidiophores in denser fascicles, acicular to narrowly obclavate conidia, ca. 1.5-2.5 µm wide. Superficial secondary mycelium is not formed.

(5) *Pseudocercospora omphacodes* (Ell. & Holw.) U. Braun & C. T. Rogerson comb. nov.

Bas.: *Cercospora omphacodes* Ell. & Holw., J. Myc. 1, p.5 (1885), type - on *Phlox divaricata*, USA, Decorah, Iowa, 10-8-1884, Holway (NY).

Syn.: *Cercospora phlogina* Peck, N. Y. State Mus. Bull. 150, p.24 (1911).

On *Phlox longifolia*, USA, Box Elder Co., Utah, 29-6-1967, Rogerson (NY).

C. omphacodes is a common parasite on various *Phlox* species (Chupp 1954). The conidiophores possess inconspicuous, unthickened conidial scars. Hence, this species must be referred to *Pseudocercospora*. The present collection is characterized as follows: stromata well developed, ca. 25-80 µm diam., coloured, conidiophores in dense, rich fascicles, ca. 20-80 x 2-4 µm, subhyaline to pale olivaceous, conidia solitary, cylindric, subclavate, narrowly obclavate, 15-55 x 3-3.5 µm, 0-3-septate, almost hyaline to pale olivaceous, smooth.

(6) *Ramularia achilleae-millefolii* U. Braun & C. T. Rogerson spec. nov.

Leaf spots irregular, entire leaf tips or segments ne-

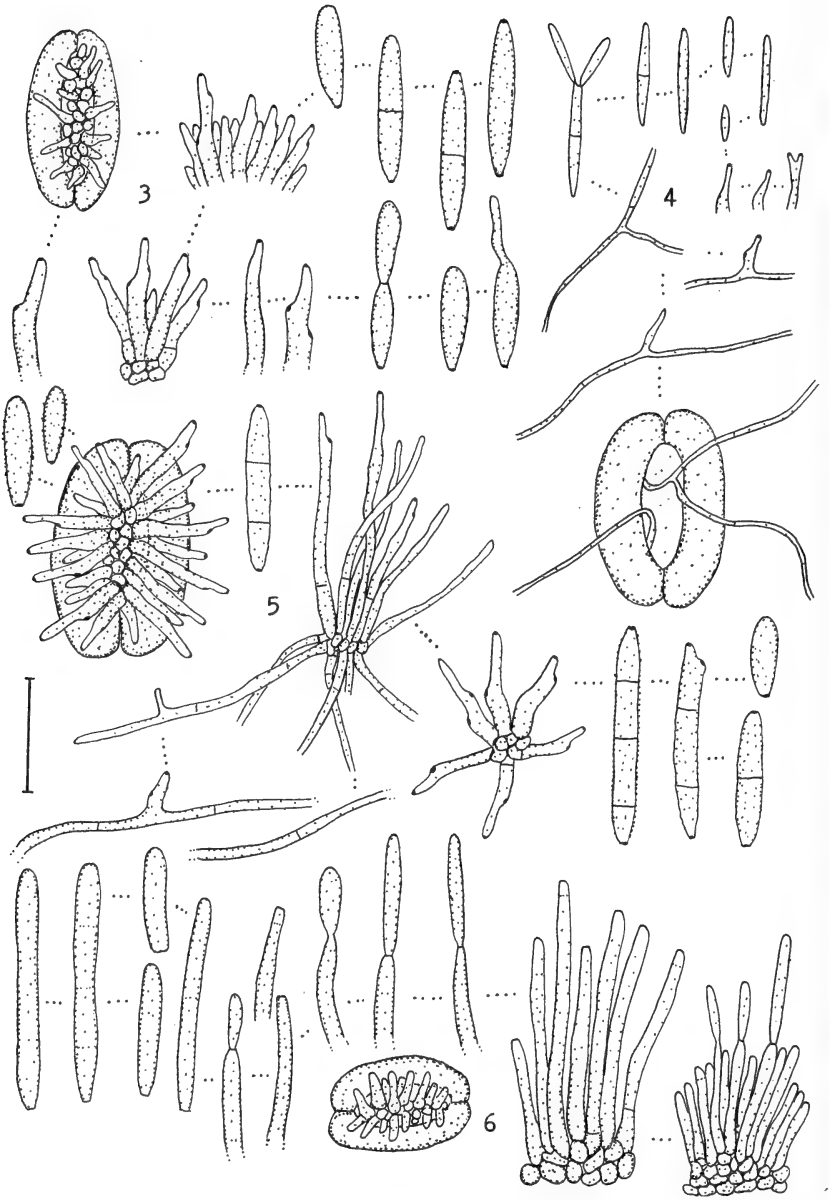


Fig. 3-6: Mycelium, conidiophores, conidia of (3) *Ramularia achilleae-millefolii* spec. nov., (4) *R. maculicola* spec. nov., (5) *R. epipactidis* spec. nov., (6) *Stigmina collinsiae* spec. nov. Scale 20 µm. U. Braun del.

crotic, yellowish, brown, greyish brown, caespituli amphigenous, punctiform, pale greyish, mycelium internal, ca. 1-3 µm wide, septate, sparely branched, hyaline, forming small to moderately large hyphal aggregations (stromata), 10-35 µm diam., substomatal, occasionally intraepidermal, hyaline. Conidiophores in small to fairly rich fascicles, through stomata, occasionally erumpent through the cuticle, ca. 10-30 x 2-3.5 µm, simple, straight, subcylindric to slightly flexuous, geniculate-sinuous, hyaline, smooth, aseptate, rarely with a single septum, conidial scars conspicuous, slightly thickened and darkened. Conidia solitary or in short chains, ellipsoid-ovoid, subcylindric, 8-22 x 2.5-4.5 µm, 0-1-septate, hyaline, smooth to verruculose. Fig. 3

Maculae irregulares, flavidae, brunneae, griseo-brunneae. Caespituli amphigeni, punctiformes, pallide grisei. Mycelium immersum: hyphae ca. 1-3 µm latae, septatae, interdum ramosae, hyalinae. Stromata substomatalia, interdum intraepidermalia, ca. 10-35 µm diam., hyalina. Conidiophora fasciculata, per stoma emergentia vel erumpentia, ca. 10-30 x 2-3.5 µm, simplicia, erecta, subcylindrica vel leniter flexuosa, geniculata-sinuosa, hyalina, laevia, saepe continua. Cicatrices conidiales conspicuae, incrassatae. Conidia solitaria vel catenata, ellipsoidea, ovoidea, subcylindrica, 8-22 x 2.5-4.5 µm, 0-1 septata, hyalina, laevia vel verruculosa.

Holotypus: on *Achillea millefolium* L. (Asteraceae), USA, Weber Co., Heater Hollow near junction with South Fork of Ogden River, 19-7-1981, Rogerson 81-211 (NY). Isotypus: HAL.

This species is also known from Europe (Sweden, Gunnerbeck, 1967, sub *Ramularia* spec. and Hungary, Mátraháza, 1938, Moesz, sub *Ramularia achilleae* Moesz, nom. nud., BP).

(7) *Ramularia arvensis* Sacc. var. *cercosporelloides* U. Braun & C. T. Rogerson var. nov.

Conidia catenate, subcylindric, acicular, 10-100 x 1.5-3 µm, mostly 30-70 x 2 µm, 0-3 (-4)-septate. Fig. 8

Conidia catenata, subcylindrica, acicularia, 10-100 x 1.3-3 µm, saepe 30-70 x 2 µm, 0-3 (-4) septata.

Holotypus: on *Potentilla glandulosa* Lindl. (Rosaceae), USA, Cache Nat. Forest, Logan Canyon, Bear River Mts., Cache Co., Utah, 15-8-1983, Rogerson (NY).

The present collection belongs to *R. arvensis* s.lat. (conidiophores hyaline, in dense, rich fascicles, conidia at least partly catenate), but differs from "normal" specimens by very long, narrow conidia (var. *arvensis*: conidia ca. 10-35 (-50) x 2-5 µm, 0-2 (-3)-septate).

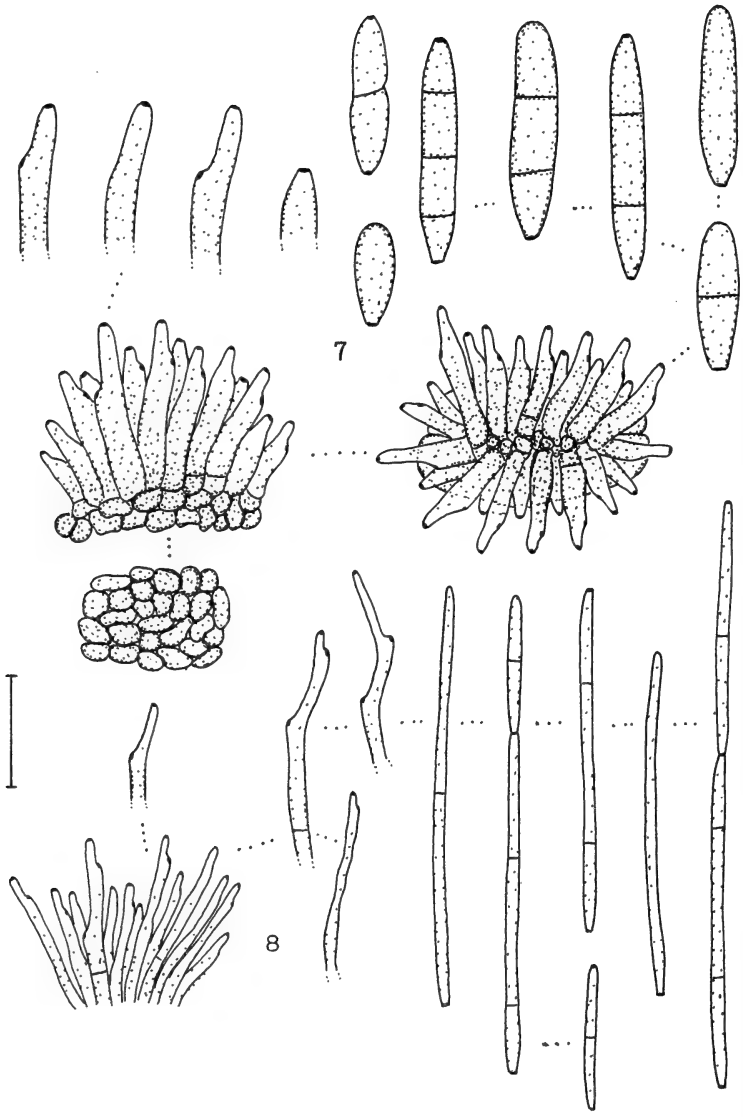


Fig. 7-8: Stromata, conidiophores, conidia of (7) *Phaeoramularia collomiae* spec. nov., (8) *Ramularia arvensis* var. *cercosporelloides* var. nov. Scale 20 µm. U. Braun del.

(8) *Ramularia maculicola* U. Braun & C. T. Rogerson spec. nov.

Leaf spots amphigenous, subcircular to angular-irregular, 2-15 mm diam., brown, margin indefinite (leaf spots caused by *Ramularia taraxaci*), primary mycelium internal, secondary mycelium external, superficial, arising through stomata, hyphae about 1 µm wide, hyaline, septate, sparsely branched, smooth. Conidiophores solitary, arising from superficial hyphae, as lateral branchlets, 5-15 x 1.5-3 µm, simple, aseptate, hyaline, smooth, conidial scars very minute, but conspicuous. Conidia catenate, occasionally in branched chains, narrowly ellipsoid-ovoid, fusiform, 4-15 x 1-2 µm, 0-1-septate, hyaline, smooth. Fig. 4

Maculae amphigenae, suborbiculares, angulares, irregulares, 2-15 mm diam., brunneae, sine margine distincto. Mycelium primarium immersum. Mycelium secundarium superficiale: hyphae ca. 1 µm latae, hyalinae, septatae, leniter ramosae, laeviae. Conidiophora solitaria, ex hyphis mycelialibus secundariis lateraliter oriunda, 5-15 x 1.5-3 µm, simplicia, continua, hyalina, laevia. Cicatrices conidiales minutae, conspicuae. Conidia catenata, anguste ellipsoidea, ovoidea, fusiformia, 4-15 x 1-2 µm, 0-1 septata, hyalina, laevia.

Holotypus: on *Taraxacum officinale* Wigg. (Asteraceae), mixed infection with *R. taraxaci*, USA, Kane Co., Duck Creek Campground, Dixie Nat. Forest, Utah, 4-9-1987, Rogerson 87-124 (NY). Isotypus: HAL.

R. maculicola is a very unusual *Ramularia* species. The biology of this species and its relation to *Ramularia taraxaci* are unclear (hyperparasite, secondary invader or phytoparasite?). *R. maculicola* is easily distinguishable from *R. taraxaci* by superficial hyphae and very small conidia.

(9) *Ramularia epipactidis* U. Braun & C. T. Rogerson spec. nov.

Leaf spots amphigenous, brown, subcircular, elliptic to oblong, sometimes linear, between veins, 1-10 mm diam. or 3-30 x 1-6 mm, margin indefinite or brownish to purple-reddish, caespituli amphigenous, mostly hypophyllous, greyish-white, punctiform to subeffuse, mycelium internal, almost colourless, septate, branched, ca. 1-3 µm wide, forming small to moderately large hyphal aggregations (stromata) in the substomatal cavities and epidermal cells, subhyaline to faintly coloured, occasionally some superficial, secondary hyphae formed, hyaline, septate, smooth or almost so. Conidiophores fasciculate, fascicles variable, small, loose, divergent to fairly rich and dense, arising through stomata, from substomatal hyphal knots, or erumpent through the cuticle, ca. 5-40 x 2-4 µm, straight and subcylindric to flexuous, geniculate-sinuous, simple, continuous to sparsely

septate, smooth, hyaline or subhyaline (faintly greenish), conidial scars conspicuous, slightly thickened and darkened. Conidia catenate, occasionally in branched chains, narrowly ellipsoid-ovoid, fusiform to mostly subcylindric, 8-35 x 2.5-4 µm, 0-3-septate, verruculose, hyaline or subhyaline (faintly greenish), hila slightly thickened and darkened. Fig. 5

Maculae amphigenae, brunneae, suborbiculares, ellipticae, oblongae, interdum lineares, 1-10 mm diam. vel 3-30 x 1-6 mm, sine margine disticto vel margine angusti brunneo vel purpureo cinctae. Caespituli amphigeni, saepe hypophylli, punctiformes, subeffusi. Mycelium immersum: hyphae fere incolores, septatae, ramosae, ca. 1-3 µm latae. Stromata substomatalia et intraepidermalia, subhyalina. Mycelium secundarium interdum evolutum: hyphae hyalinae, septatae, sublaeviae. Conidiophora fasciculata, per stoma emergentia vel erumpentia, ca. 5-40 x 2-4 µm, erecta, subcylindrica vel flexuosa, geniculata-sinuosa, simplicia, continua vel septata, laevia, hyalina, subhyalina. Cicatrices conidiales conspicuae, leniter incrassatae, obscurae. Conidia catenata, anguste ellipsoidea-ovoidea, fusiformia, subcylindrica, 8-35 x 2.5-4 µm, 0-3 septata, verruculosa, hyalina, subhyalinia. Hila leniter incrassata, obscura.

Holotypus: on *Epipactis gigantea* Dougl. (Orchidaceae), USA, Weber Co., Ogden, south of Ogden River, Utah, 26-8-1975, Rogerson 75-251 (NY). Isotypus: HAL.

Paratypi: on *Epipactis gigantea*, same locality, 29-7-1982, Rogerson 82-111 (NY, HAL).

This species is somewhat *Stenella*-like, but on account of the colourless conidiophores, we prefer to place it in *Ramularia*.

(10) *Stigmina collinsiae* U. Braun & C. T. Rogerson spec. nov.

Leaf spots almost absent to diffuse, irregular, greenish, yellowish-ochraceous, finally yellowish-brown, ca. 1-8 mm diam., margin indefinite, conidiomata hypophyllous, punctiform, minute brownish dots (caused by immersed stromata), hoary, mycelium internal, forming well developed stromata, ca. 20-100 µm diam., subcircular in outline, yellowish, ochraceous to pale olivaceous, composed of swollen hyphae, ca. 2-6 µm diam., stromata at first substomatal, but soon rupturing the stomata, expanded, somewhat erumpent, often confluent. Conidiophores in small to rich fascicles, arising from stromata, ca. 10-60 x 2.5-5 µm, simple, filiform, straight to flexuous, subhyaline to olivaceous, smooth, continuous, conidiogenous cells integrated, terminal, monoblastic, determinate, percurrent, annelations inconspicuous. Conidia solitary, subcylindric, 15-45 x 2-4 µm, subhyaline to faint-

ly greenish, aseptate, occasionally with 1-3 septum-like lines, smooth to faintly rough, apex rounded, base truncate. Fig. 6

Maculae indistinctae vel diffusae, irregulares, viridulae, flavido-ochraceae, flavido-brunneae, ca. 1-8 mm diam. Conidiomata hypophylla, punctiformes, pallide brunnea. Mycelium immersum. Stroma bene evolutum, rotundatum, ca. 20-100 µm diam., ex hyphis inflatis, ochraceis, pallide olivaceis compositum. Conidiophora laxe vel dense fasciculata, ca. 10-60 x 2.5-5 µm, simplicia, filiformia, erecta vel flexuosa, subhyalina vel olivacea, laevia, continua, cellulae conidiogenae integratae, terminaliae, monoblasticae, determinatae, percurrentes. Conidia solitaria, subcylindrica, 15-45 x 2-4 µm, subhyalina, viridula, 0 (-3) septata, laevia vel verruculosa, apice rotundata, basi truncata.

Holotypus: on *Collinsia parviflora* Dougl. (Scrophulariaceae), USA, Weber Co., North Fork County Park, Utah, 29-5-1989, Rogerson 89-100 (NY). Isotypus: HAL.

This is a very unusual species. The stromata and conidiophores are only faintly coloured, but on account of the monoblastic, percurrent conidiogenous cells, it must be placed in *Stigmina*. It belongs to a group of *Pseudocercospora*-like *Stigmina* species.

(11) Our knowledge on the distribution of phytoparasitic hyphomycetes in Utah is rather poor (cf. Farr et al. 1989). Most of the following species or hosts are new to Utah (all specimens have been collected by C. T. Rogerson and they are deposited in NY, duplicates in HAL):

Didymaria wyethiae (Ell. & Ev.) Solh., on *Wyethia amplexicaulis*, Weber Co., 25-6-1991, Rogerson 91-62. *Neoramularia asteris* (Solh.) U. Braun (= *Ovularia asteris* Solh.), on *Aster engelmannii*, Weber Co., 17-8-1986, Rogerson 86-125. *Phaeoramularia geranii* (Cooke & Shaw) U. Braun (= *Cercosporella geranii* Cooke & Shaw, *Cercospora ithacensis* Chupp, *Pseudocercospora geranii* (Cooke & Shaw) U. Braun), on *Geranium richardsonii*, Weber Co., 17-8-1987, Daggett Co., 9-8-1987, Rogerson (only NY), on *G. viscosissimum*, Box Elder Co., 29-6-1991, Rogerson 91-64. *Phaeoramularia punctiformis* (Schlecht.) U. Braun (= *Ramularia montana* Speg.), on *Epilobium angustifolium*, Cache Co., 15-8-1983, Rogerson 83-138. *Ramularia actaeina* U. Braun (= *R. actaeae* auct. p.p.), on *Actaea rubra*, Weber Co., 16-8-1989, Rogerson 89-105. *R. arvensis* Sacc., on *Potentilla gracilis*, Sevier Co., 19-8-1990, Rogerson 90-93. *R. asteris* (Plowr. & Phill.) Bub., on *Aster eatoni*, Weber Co., 17-8-1987, Rogerson 87-125, new host! *R. biflora* P. Magn. ex Lindau (= *R. ionophila* J. J. Davis), on *Viola nuttallii*, Weber Co., 21-6-1991, Rogerson 91-60 and *Viola purpurea*, Weber Co., 1-6-1989, Rogerson 89-101. *R. carneola* (Sacc.) Nannf., on *Scrophularia lanceolata*, Weber Co., 21-6-1991, Rogerson 91-59, new to North America!

R. delphinii Jaap, on *Delphinium occidentale*, Cache Co., 11-6-1989, Rogerson 89-102. *R. delphiniicola* U. Braun (= *Ovularia delphinii* Solh.), on *Delphinium nuttallianum*, Weber Co., 21-6-1991, Rogerson 91-57. *R. filaris* Fres. (= *R. senecionis* (Berk. & Br.) Sacc.), on *Senecio integerrimus*, Weber Co., 13-6-1991, Rogerson 91-56 and *Senecio serra*, Weber Co., 16-8-1989, Rogerson 89-106. *R. giliae* Sprague, on *Microsteris gracilis* var. *humilior*, Weber Co., 15-4-1986, Rogerson 86-123. *R. grevilleana* (Tul.) Joerst. (= *R. tulasnei* Sacc.), on *Fragaria virginiana*, Weber Co., 21-6-1991, Rogerson 91-58. *R. lophanthi* Ell. & Ev., on *Agastache urticifolia*, Weber Co., 13-8-1991, Rogerson 91-65. *R. lupinicola* (Pollack) U. Braun (= *Ovularia lupinicola* Pollack), on *Lupinus argenteus*, Weber Co., 20-8-1986, Rogerson 86-127. *R. rudbeckiae* Peck, on *Rudbeckia occidentalis*, Weber Co., 16-8-1989, Rogerson 89-103. *R. sambucina* Sacc. (= *R. glauca* Ell. & Ev.), on *Sambucus caerulea*, Weber Co., 17-8-1987, Rogerson 87-123. *R. sidalceae* Ell. & Ev., on *Iliamna rivularis*, Weber Co., 6-8-1983, Rogerson 83-104 and *Sidalcea oregana*, Weber Co., 25-6-1991, Rogerson 91-63. *R. smilacinae* J. J. Davis, on *Smilacina racemosa*, Weber Co., 14-8-1986, Rogerson 86-124. *R. urticae* Ces., on *Urtica dioica*, Weber Co., 16-8-1989, Rogerson 89-107. *R. valerianae* (Speg.) Sacc., on *Valeriana occidentalis*, Weber Co., 21-6-1991, Rogerson 91-61, new host! *R. variabilis* Fuck., on *Verbascum thapsus*, Weber Co., 10-8-1986, Rogerson 86-126.

Literature

Braun, U. (1992): Taxonomic notes on some species of the *Cercospora* complex. Nova Hedwigia 55(1-2): in press.

Chupp, C. (1954): A monograph of the fungus genus *Cercospora*. Ithaca, New York.

Deighton, F. C. (1990): Observations on *Phaeoisariopsis*. Myc. Res. **94**(8): 1096-1102.

Farr, D. F., Bills, G. F., Chamuris, G. P. and A. Y. Rossman (1989): Fungi on Plants and Plant Products in the United States. St. Paul.

Gunnerbeck, E. (1967): *Ramularia* and related fungi on Phanerogams in Uppland (Sweden). Sv. bot. Tidskr. **61**: 126-138.

MYCOTAXON

Volume XLVI, pp. 275-284 January-March 1993

TWO NEW COPROPHILOUS PEZIZALES FROM THE SULTANATE OF OMAN

[1]J. Gené, [2]A.E. ElShafie & [1]J. Guarro

[1]Unitat de Biologia i Microbiologia, Facultat de Medicina, Universitat de Barcelona, 43201 Reus, Tarragona, Spain. [2]Department of Biology, College of Science, Sultan Qaboos University, Sultanate of Oman.

ABSTRACT

Two new species of coprophilous Pezizales are described from the Sultanate of Oman: ***Thecotheus harasisus***, characterized by ornamented and apiculate ascospores, and ***Coprotus dhofarensis***, with very elongated ectal excipular cells.

Keywords: Coprophilous fungi, Pezizales, ***Coprotus dhofarensis***, ***Thecotheus harasisus***, Sultanate of Oman.

INTRODUCTION

Almost no information is available for the coprophilous Pezizales from the Sultanate of Oman, although a few reports of coprophilous fungi are available for the surrounding region (Abdullah *et al.*, 1976; Abdullah, 1982). Thus, it was not surprising to encounter in our studies an apparently undescribed species of both ***Coprotus*** Korf & Kimbr. and ***Thecotheus*** Boud. ***Coprotus*** was revised by Kimbrough *et al.* (1972) for North America although a number of additional species have been subsequently or simultaneously published (Moravec, 1971; Bell & Kimbrough, 1973; Jeng & Krug, 1977; Thind *et al.*, 1978; Gibson & Kimbrough, 1980). Since the publication of Kimbrough (1969) additional coprophilous species of ***Thecotheus*** have been proposed by Kaushal (1980) and Krug & Khan (1987). A revised key to the species was provided by the latter authors. Since our collections appear to differ from all known species they are herein described and illustrated.

TAXONOMY

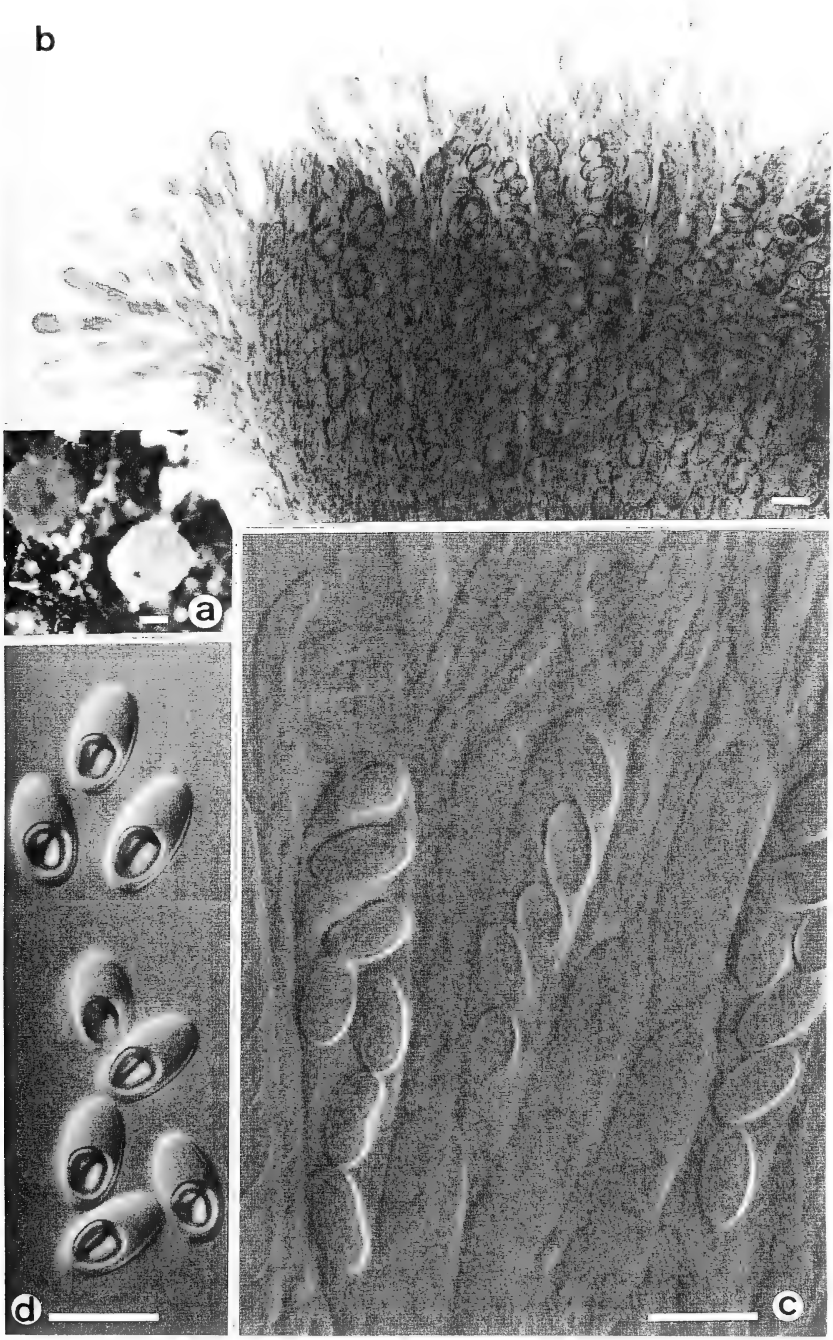
Coprotus dhofarensis Gené, ElShafie et Guarro **sp. nov.** Figs. 1-3
Etym: latinized from Dhofar province in south Oman.

Apothecia dispersa, sessilia, superficialia, cum rhizoideo in baside, 200-350 x 290-500(650) μm, primo subglobosa et translucida vel luteola, in maturitate cupuliformes vel turbinata et aurantiaca vel aurantiobrunnea. Excipulum e stratis duobus compositum: excipulum ectalis cum textura globulosa, cellulae 15-26 μm crassae, hyalinae vel luteolae, parietibus tenuibus, cum longis appendicibus marginalibus 60-95 x 4-6.5(7.5) μm magnis exhibens, hyalinae, non septatae, laeviae, nonnumquam ramosae, cylindraei in apice rotundati, mutant se claviformes, frequenter apex inflatus usque ad 14 μm diam. crassae, guttulas parvas luteolas continente, curvi et frequenter operant partem superiorem hymenii; excipulum medullaris texturae globulosae vel angularis, cellulis hyalinis, parietibus tenuibus, 10-15 μm diam. crassis. Asci octospori, 70-98 x 10-13 μm, operculati, cylindracei vel leviter clavati, in apice rotundati, in maturitate sunt leviter truncati et tunc coartant se in baside, non iodo coerulescentes, cum "Congo red" aequabiliter tincti. Paraphyses filiformes, 60-80 x 2-3 μm, hyalinae, septatae, simplices, rarus ramosae. Ascosporae uniseriales, nonnumquam biseriales, 10-13.5 x 6-7 μm magnae, unicellulares, ellipsoideae, hyalinae, glabrae, bullulam unam exhibentes. Conidia incognita.

Apothecia scattered, sessile, superficial, attached to the substrate by rooting hyphae, 200-350 x 290-500(650) μm, at first subglobose and translucid or light yellow, at maturity becoming cup-shaped to turbinate and pale orange to brownish-orange under natural light. *Excipulum* cyanophilous, two-layered: *ectal excipulum* of *'textura globulosa'*, cells 15-26 μm diam., pale yellow, staining uniformly reddish in Congo red, elongating outwardly, and forming a compact fringe of long, smooth, thin-walled appendages, 60-95 x 4-6.5(7.5) μm, exceeding the height of the hymenium by 50-70 μm, sometimes 1-septate near the base, usually unbranched, at first cylindrical with a rounded apex, later clavate, often with swollen apex reaching 14 μm diam., filled with

---

Fig. 1. ***Coprotus dhofarensis*** (FMR 3921). **a**,**b**, apothecia (a, bar=100 μm; b, bar=10 μm); **c**, asci and paraphyses (bar=10 μm); **d**, ascospores (bar=10 μm).


b
a
c
d

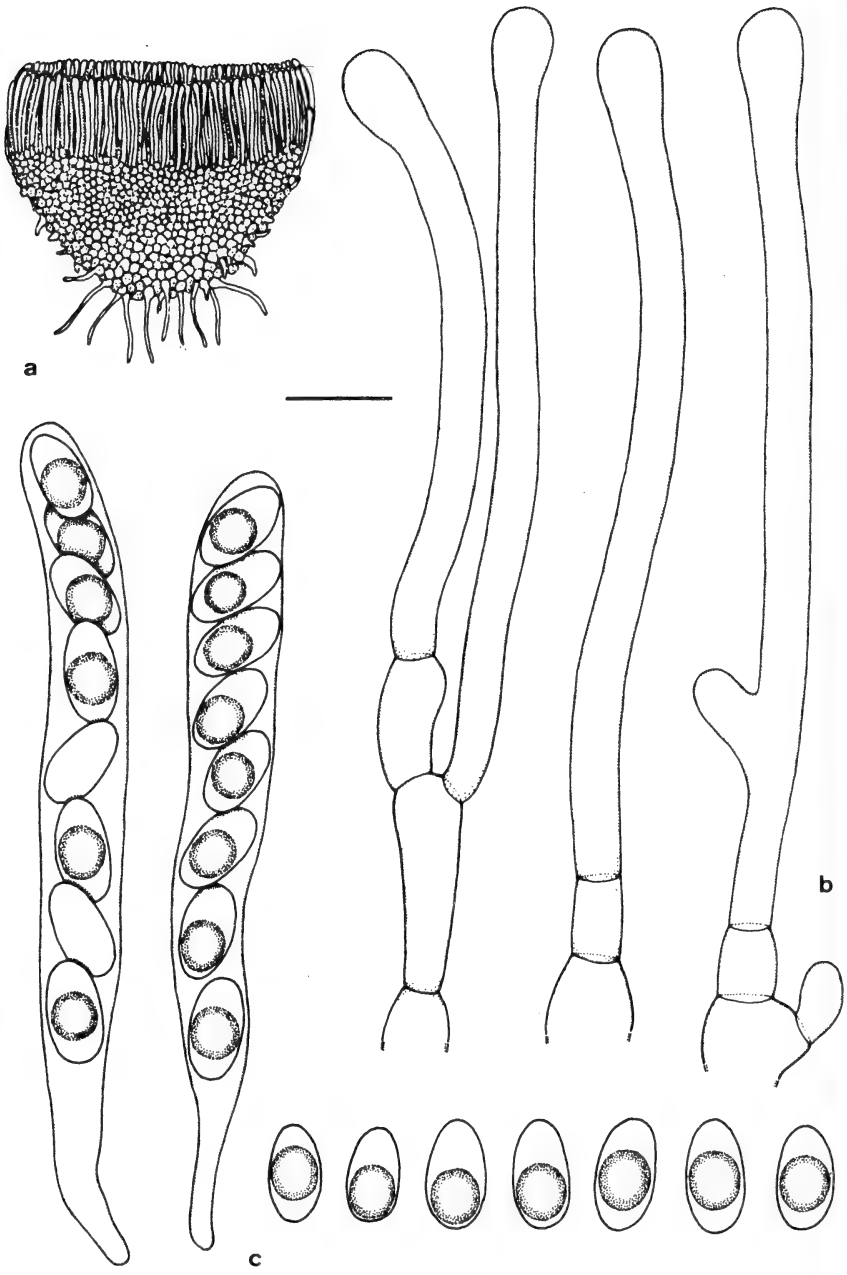


Fig. 2. ***Coprotus dhofarensis*** (FMR 3921). **a**, apothecium (bar = 100 μm); **b**, excipular appendages (bar = 10 μm); **c**, asci and ascospores (bar = 10 μm).

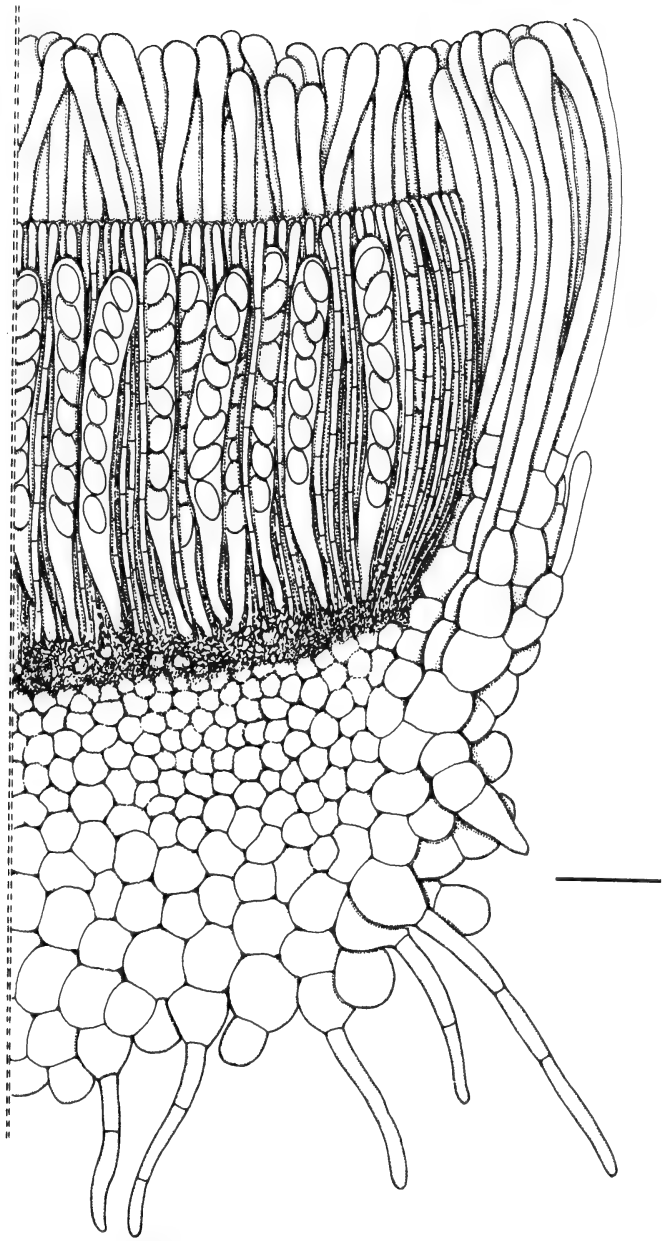


Fig. 3. ***Coprotus dhofarensis*** (FMR 3921). apothecium section (bar = 25 μm).

pale yellowish guttules, at maturity usually incurved and covering the upper part of the hymenium; external cells occasionally becoming bulbous or differentiated as short and straight hyphal elements, unbranched, 1-3 celled, with rounded ends and bulbous at the base, 3-5 μm diam.; *medullary excipulum* of *'textura globulosa'* to *'angularis'*, cells 10-17 μm diam., hyaline to pale yellow. Hymenium light yellow, concave, about 140-475 μm thick. *Asci* 8-spored, 70-98 x 10-13 μm, operculate, cylindrical to subclavate, rounded above, becoming subtruncate at maturity, gradually tapering below into a short stipe, non-amyloid, staining uniformly in Congo red. *Paraphyses* abundant, straight, filiform, 60-80 x 2-3 μm, exceeding the length of the asci by 10-15 μm, septate, rarely branched, hyaline, reddish in Congo red. *Ascospores* uni- or sometimes biseriate, 10-13.5 x 6-7 μm, 1-celled, ellipsoidal, hyaline, smooth-walled, with each cell containing a single de Bary bubble. Anamorph unknown.

Holotype: FMR 3921, on goat dung, Hashir, Dhofar province, Oman, 20 Nov. 1990, leg. A.E. ElShafie. Isotypes have been deposited at IMI and at Sultan Qaboos University [SQU 51(Z4)].

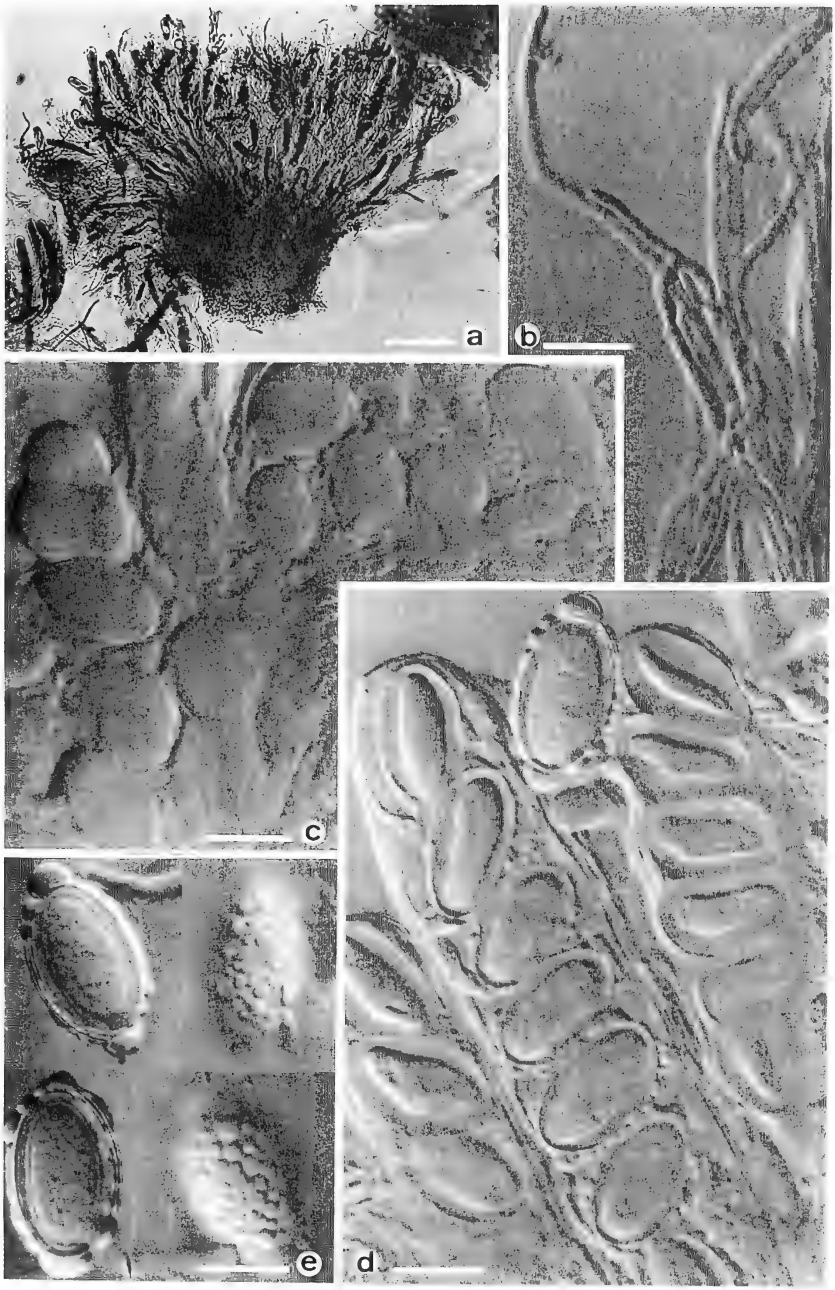
The main characteristic of this species is the presence of a fringe of elongate appendages overarching the apothecia. ***Coprotus marginatus*** Kimbrough *et al.* (Kimbrough *et al.*, 1972) also has similar appendages but the apothecia are larger, reaching 1.6 mm in diam., discoid to lenticular and white to yellowish, while the ascospores are smaller (8.5-10 x 4-5 μm). The colour of the apothecia and the size of the ascospores are almost identical to those of ***C. aurora*** (Cr.) Thind & Waraitch (Kimbrough *et al.*, 1972), but this species lacks the typical elongate appendages.

Thecotheus harasisus Gené, ElShafie et Guarro **sp. nov.** Figs. 4,5
Etym: latinized from Harsusi, a member of Bedu tribe in Oman where the Arabian oryx was reintroduced.

Apothecia dispersa, sessilia et superficialia, 390-550 x 300-600 μm, primo subglobosa et alba, in maturitate cupuliformes et luteola. Excipulum ectalis e textura angulare, cellulae 15-20 μm crassae, ad marginem cellularum bulborum compositum; excipulum

---

Fig. 4. ***Thecotheus harasisus*** (FMR 4159). **a**, apothecium (bar=100 μm); **b**, paraphyses (bar=10 μm); **c**, external excipular cells (bar=10 μm); **d**, asci (bar=10 μm); **e**, ascospores (bar=10 μm).


a
b
c
d
e

medullaris cum textura globulosa, cellae usque ad 10 µm crassae. Asci octospori, 244-270 x 19-23 µm, operculati, cylindracei, in apice rotundati, deveniunt truncati ad maturitatem et tunc coartant se in basede, iodo coerulescentes, cum "Congo red" aequabiliter tincti. Paraphyses filiformes, hyalinae, septatae, simplicis, ramosae aut non ramosae, nonnumquam cum apice leviter inflati. Ascosporae uniseriales, 23-28 x 12-13.5 µm magnae, unicellulares, ellipsoideae, hyalinae vel subhyalinae, parietibus internis crassis, 1.5-2 µm crassis, parietibus externis tenuibus cum notis globosis et praeditis cum apiculis polaribus; polares apicula globosa vel subglobosa, subhyalina, 4.5-6.5 µm diam. crassa, cum "Cotton blue" fortiter tincta. Conidia ignota.

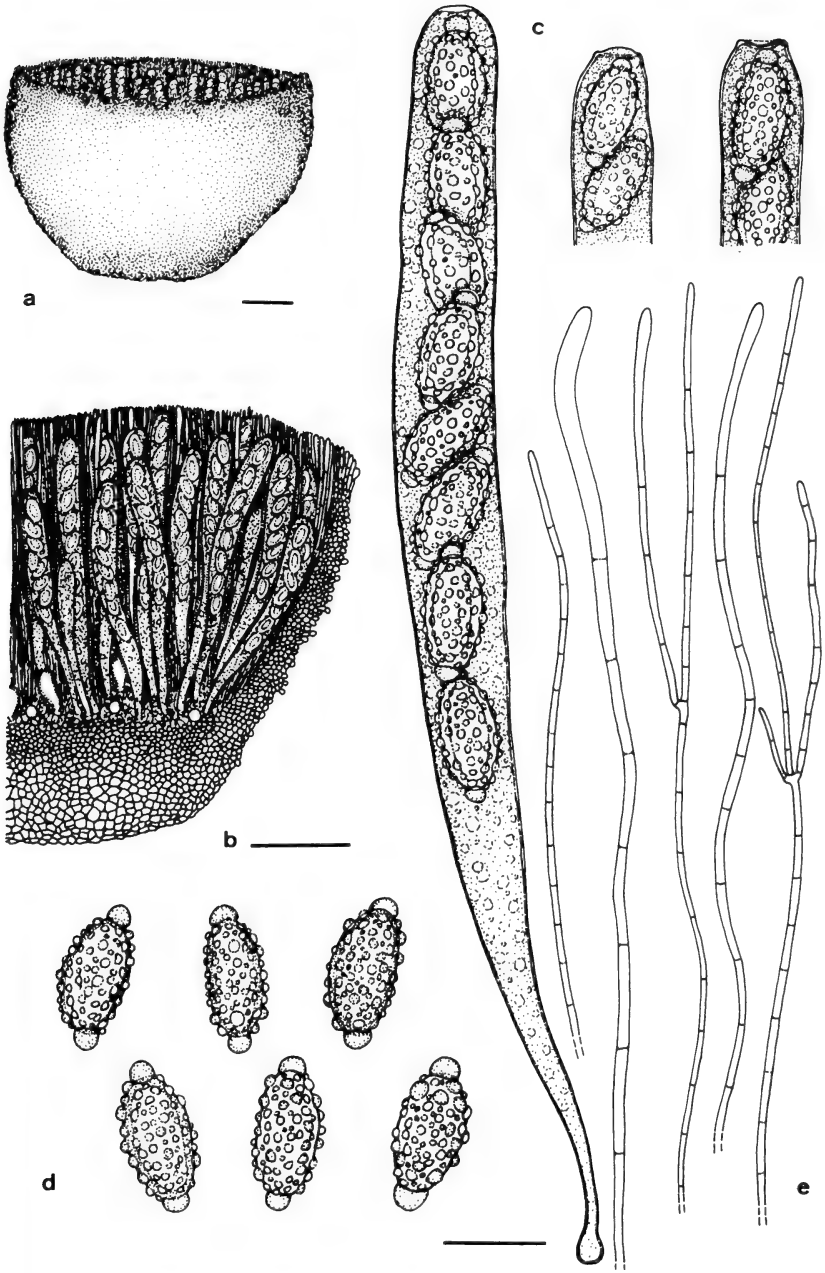
Apothecia scattered, sessile and superficial, 390-550 x 300-600 µm, at first subglobose and white, becoming cupulate and light yellow. *Ectal excipulum* of *'textura angularis'*, 15-20 µm diam., becoming bulbous toward the periphery; *medullary excipulum* predominantly of *'textura globulosa'*, cells reaching 10 µm diam. ***Asci*** 8-spored, 244-270 x 19-23 µm, operculate, cylindrical, narrowed toward the base, rounded at the apex when young but becoming truncate at maturity, the entire surface blueing in Melzer's iodine reagent, staining uniformly in Congo red, operculum with a distinct line of dehiscence. *Paraphyses* filiform, hyaline, septate, branched or unbranched and sometimes slightly enlarged at the apex. *Ascospores* uniseriate, 23-28 x 12-13.5 µm, 1-celled, ellipsoidal, hyaline to subhyaline, with a thick inner wall about 1.5-2 µm wide and a thin outer wall with numerous globose markings of variable size, mostly 1-2 µm diam., staining intensely in cotton blue, young ascospore lacks spore-wall markings but rather develop thick mucilagenous sheath; polar apiculi spherical to hemispherical, subhyaline, 4.5-6.5 µm diam., staining deeply in Cotton blue. Anamorph unknown.

Material examined: FMR 4159 (**holotype**), on oryx dung, Yalooni, Jidat Al Harasis Al Dakhlia province, Sultanate of Oman, 10 Jan. 1990, leg. A.E. ElShafie, **isotypes** have been deposited at IMI and at Biol. Dept., Sultan Qaboos University [SQU 34]; SQU 8, on cow dung, Salalah, Dhofar province, Sultanate of Oman, 9 Feb. 1989, leg. A.E. ElShafie.

Other similar coprophilous species are ***T. cinereus*** (Cr. & Cr.) Chen. (Kimbrough, 1969), which also has distinctly operculate asci and apiculate and ornamented ascospores

---

Fig. 5. ***Thecotheus harasisus*** (FMR 4159). **a**,**b**, apothecia (a, bar=100 µm; b, bar=50 µm); **c**, asci (bar=10 µm); **d**, ascospores (bar=10 µm); **e**, paraphyses (bar=10 µm).


a
b
c
d
e

but the apothecia are lilaceous to purple-brown and the ascospores are larger (30-42 x 15-18 μm). ***T. himalayensis*** Kaushal (1980) has ornamented but smaller ascospores (12-15.5 x 6-7 μm).

AGKNOWLEDGEMENS

We would like to express our gratitude to Dr. M. Valldosera for the initial examination of this material, Dr. J.W. van Brummelen (Rijksherbarium, Leiden) for his comments about the new species of ***Coprotus***, Dr. E. Descals (Universitat de les Illes Balears) and Dr J.C. Krug (University of Toronto) for reviewing this article.

REFERENCES

ABDULLAH, S.K. 1982. Coprophilous mycoflora on different dung types in Southern desert of Iraq. *Sydowia 35:* 1-5.

ABDULLAH, S.K., ISMAIL, A.L.S. and RATTAN, S.S. 1976. New and interesting coprophilous fungi from Iraq. *Nova Hedwigia 28:* 241-251.

BELL, A. and KIMBROUGH, J.W., 1973. ***Coprotus trichosurus*** sp. nov. from New Zealand. *Trans. Br. mycol. Soc. 61:* 190-193.

GIBSON, J.L. and KIMBROUGH, J.W. 1980. A new spherical spored species of ***Coprotus*** (Pezizales). *Mycotaxon 11:* 376-380.

JENG, R.S. and KRUG, J.C. 1977. New records and new species of coprophilous Pezizales from Argentina and Venezuela. *Can. J. Bot. 55:* 2987-3000.

KAUSHAL, S.C. 1980. A new species of ***Thecotheus*** (Pezizales) from the Western Himalaya. *Bot. Not. 133:* 319-321.

KIMBROUGH, J.W. 1969. North American species of ***Thecotheus*** (Pezizeae, Pezizaceae). *Mycologia 61:* 99-114.

KIMBROUGH, J.W., LUCK-ALLEN, E.R. and CAIN, R.F. 1972. North American species of ***Coprotus*** (Thelebolaceae: Pezizales). *Can. J. Bot. 50:* 957-971.

KRUG, J.C. and KHAN, R.S. 1987. A new species of ***Thecotheus*** from East Africa. *Mycologia 79:* 200-203.

MORAVEC, J. 1971. Discomycety celedi Thelebolaceae (Brumm.) Eckbl. z. okrescu Mladá Boleslav v Cechách. *Ceská Mykol. 25:* 150-160.

THIND, K.S., KAUSHAL, S.C. and KAUSHAL, R. 1978. The genus ***Coprotus*** in India. *J. Ind. Bot. Soc. 57:* 63-67.

MYCOTAXON

Volume XLVI, pp. 285 January-March 1993

MINIMIDOCHIUM INDICUM, A NOMENCLATURAL CORRECTION

B.P.R.VITTAL and M.DORAI

Centre for Advanced studies in Botany
University of Madras
Madras 600 025, India.

Vittal and Dorai (1991) proposed a new species of *Minimidochium*, viz. *M. indicum*, occurring on leaf litter of *Eucalyptus tereticornis* Sm. Subsequently, it was discovered that Varghese and Rao (1980) described a species of *Minimidochium* under the same name, *M. indicum* from fallen fruits of *Samadera indica* Gaertn. However, *M. indicum* Vittal and Dorai is distinctly different from *M. indicum* Varghese and Rao. Because *M. indicum* Vittal and Dorai becomes a later homonym of *M. indicum* Varghese and Rao, we now provide a new specific epithet for our taxon and propose the following nomenclatural change:

Minimidochium eucalypti Vittal and Dorai, nom. nov.

=*M.indicum* Vittal and Dorai, Mycol.Res. **95** : 502,1991.

ACKNOWLEDGEMENTS

We are extremely thankful to Dr.Rosely A.P.Grandi and Dr.Keith A.Seifert for bringing to our notice the paper by Varghese and Rao. Our thanks are also due to Dr.K.A.Seifert for reviewing the manuscript.

REFERENCES

Varghese,K.I.M and Rao,V.G. 1980. Two undescribed species of dematiaceous hyphomycetes. Norw.J.Bot. **27**: 55-57.

Vittal,B.P.R and Dorai,M. 1991. Three new deuteromycetes from *Eucalyptus* leaf litter. Mycol.Res. **95** : 501-503.

MYCOTAXON

Volume XLVI, pp. 287-290 January-March 1993

MORTIERELLA PARAENSIS N. SP. FROM BRAZILIAN SOIL

Ludwig Pfenning [1] and Walter Gams [2]

[1] Botanisches Institut, Lehrstuhl Spezielle Botanik / Mykologie, Universität Tübingen, Auf der Morgenstelle 1, 7400 Tübingen, Germany.

[2] Centraalbureau voor Schimmelcultures, P. O. Box 273, 3740 AG Baarn, The Netherlands.

Mortierella paraensis n. sp., belonging to sect. *Hygrophila*, is described. It was found in soil of primary forest in the Eastern Amazon.

During work on tropical soil and rhizosphere fungi samples were taken from primary forest as well as from cultivated areas at the Experimental Station of the EMBRAPA (Brazilian Agricultural Research Company) near Belém, State of Pará, Brazil. A new species of *Mortierella* could be isolated repeatedly from forest soil.

Mortierella paraensis Pfenning & W. Gams *sp. nov.* — Fig. 1

Coloniae celeriter crescentes, lobatae, odore alliaceo. Sporangiophora 200–400(–650) μm alta, identidem basitone ramosa, e 10–15 μm ad 2.5–4 μm sursum angustata et iterum ad 4–7 μm in summo dilatata. Sporangia 25–40(–50) μm diam., multispora. Sporae subglobosae vel globosae, leves, (4–)6.5–8(–12) μm diam. Chlamydosporae numerosae,

singulae vel catenatae, globosae, 9–17 μm diam. Zygosporae ignotae. Typus CBS 547.89, ex solo forestali in Brasilia lectus, in herb. CBS praeservatus.

Colonies fast growing on carboxymethyl cellulose (CMC), potato-carrot (PCA), soil extract (SEA), and 2% malt agars (MEA), with a daily radial increment of about 5–6 mm at 20°C, broadly lobate, aerial mycelium little developed, odour garlic-like, typical of the genus. Sporulating heavily after four days on CMC, SEA and PCA, less on MEA. Sporangiophores arising from the substratum, 200–400(–650) μm tall, with repeated basitonous ramification, tapering from 10–15 μm to 2.5–4 μm in the upper part and widening again to 4–7 μm at the tip. Sporangia 25–40 (–50) μm diam, many-spored, on dehiscence leaving a minute columella and an inconspicuous colarette. Spores subglobose–globose, smooth-walled, (4–)6.5–8(–12) μm diam. Chlamydospores commonly produced, solitary or in chains, globose, 9–17 μm diam. No zygospores were obtained after mating of the three isolates.

Temperature optimum for growth 24–35°C, maximum near 37°C.

Material examined

CBS 343.89, 344.89 and 547.89 (type strain), from soil under primary forest near Capitão Poço – Pará, Brazil, leg. L. Pfenning, June 1988 and March 1989.

Discussion

With its basitonous branching pattern and the many-spored sporangia, *M. paraensis* belongs to the section *Hygrophila* (Gams, 1977). It is close to *M. hyalina* (Harz) W. Gams, but differs from the latter by a wider sporangiophore tip, larger sporangia, and smaller and perfectly smooth-walled spores.

M. beljakovae Mil'ko and *M. kuhlmanii* W. Gams (1976) are similar in having apically widening and almost apophysate sporangiophores. *M. beljakovae* has even wider sporangiophore tips and larger chlamydospores, commonly arranged in clusters. *M. kuhlmanii* has elongate ellipsoidal spores and is homothallic. Thus *M. paraensis* is considered sufficiently distinct from both these species (see Table 1).

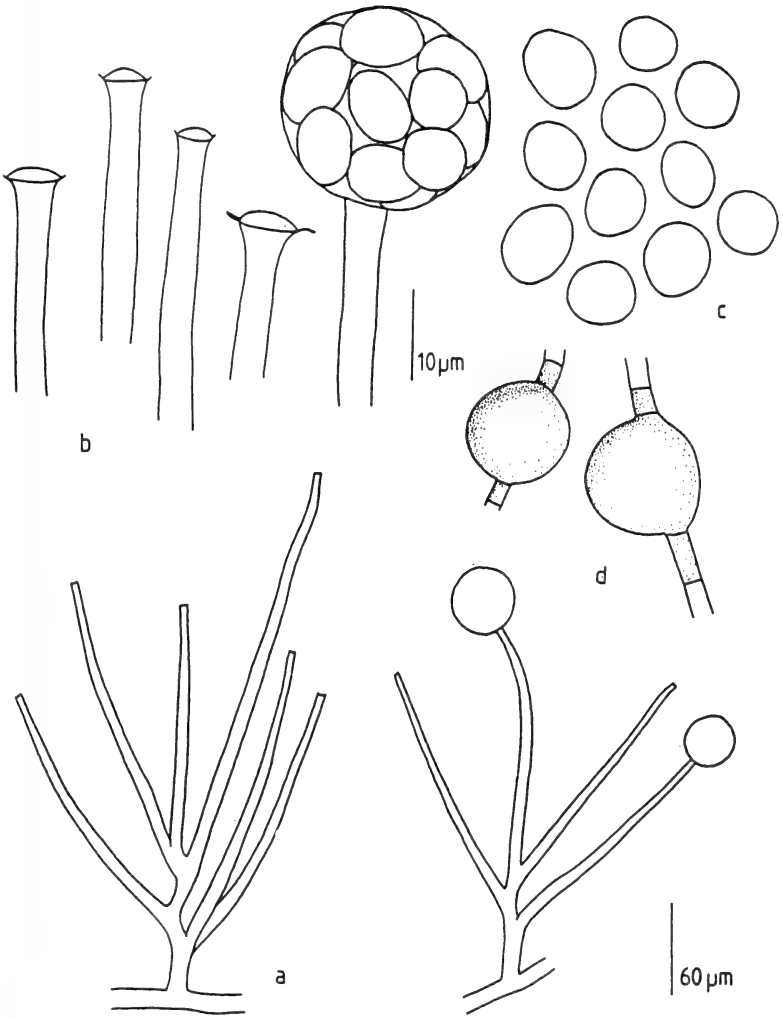


Fig. 1. *Mortierella paraensis*, a. sporangiophores, b. sporangium and sporangiophore tips, c. spores, d. chlamydospores.

Table 1. Comparison of *Mortierella paraensis*, *M. beljakovae* and *M. kuhlmanii*.

	Sporangiophores	Sporangiophore tip	Spores	Chlamydospores
M. paraensis	200–400 μm	4–8 μm	(4–)5–8 (–12) μm	9–17 μm
M. bjeljakovae	150–800 μm	7–13 μm	6–9(–11) × 5–8 μm	20–45(–60) μm
M. kuhlmanii	250–500 μm	8–14 μm	8–12(–17) × 4–5(–7) μm	9–22 μm

We are indebted to Dr Carlos Cerri (CENA – Universidade de São Paulo) and Dr Leopoldo Teixeira (EMBRAPA – Belém) for providing all infrastructural facilities and technical assistance. This work was supported by the Deutscher Akademischer Austauschdienst.

References

Gams, W., 1976. Some new or noteworthy species of *Mortierella*. Persoonia **9**: 111–140.

Gams, W., 1977. A key to the species of *Mortierella*. Persoonia **9**: 381–391.

MYCOTAXON

Volume XLVI, pp. 291-297 January-March 1993

NEW HYPHOMYCETE SPECIES FROM LITTER IN THE CHATHAM ISLANDS, NEW ZEALAND

E.H.C. McKENZIE

DSIR Plant Protection
Private Bag, Auckland, New Zealand

Four new species of hyphomycetes are described: *Chalara australis, C. distans, Circinotrichum chathamiensis* and *Cryptophiale insularis*. They were found on leaf litter of *Dracophyllum arboreum* and *Myrsine chathamica*, two endemic trees in the Chatham Islands, a small group of islands about 860 km east of the South Island of New Zealand. There is a recent account of the fungi of the Chatham Islands (McKenzie 1991).

Chalara australis McKenzie sp. nov. Fig. 1A

Coloniae inconspicuae, effusae. Mycelium extermum, ex hyphis brunneis, ramosis, laevibus, septatis, 1.5-2.5 μm crassis. Conidiophora macronematosa, mononematosa, singula, eramosa, erecta, recta vel parum curvata, laevia, 0-1 septata, pallide, 30-50 μm longa. Cellulae conidiogenae monophialidicae, in conidiophoris incorporatae, terminales, lageniformes, 25-40 μm longae; venter subcylindricus (3-) 7-15 (-18) x (4-) 4.5-6 (-10) μm; collum cylindricum, 20-30 (-36) x 2.5-3 (-3.5) μm; transitio e ventre ad collum gradata; ratio longitudinis mediae colli et ventris = 2.5:1. Conidia endogena, catenulate extrusa, hyalina, cylindrica, laevia, 1-septata, (15.5-) 18-20 (-22.5) x 2-2.5 μm, apice rotundato, basi truncata; ratio conidii long./lat. = 8.2:1.

In foliis dejectis epacridaceae speciei Dracophylli arborei Ckn.
Holotypus PDD 52058.

Colonies inconspicuous, effused, brown, with white layer of conidia. Mycelium superficial, brown, branched and anastomosing, sometimes forming sheets, smooth, septate, 1.5-2.5 μm thick. Conidiophores macronematous, mononematous, single, unbranched, erect, straight or slightly curved, smooth, 0-1 septate, sometimes reduced to phialide, borne directly on hyphae, pale, 30-50 μm long (including conidiogenous cell). Conidiogenous cells monophialidic, integrated, terminal, lageniform, 25-40 μm long; venter subcylindrical, (3-) 7-15 (-18) x (4-) 4.5-6 (-10) μm; collarette cylindrical, 20-30 (-36) x 2.5-3 (-3.5) μm; transition from venter to collarette gradual; ratio of mean lengths of collarette and venter = 2.5:1. Conidia endogenous,

extruded in long chains, hyaline, cylindrical, smooth, medianly 1-septate, (15.5-) 18-20 (-22.5) x 2-2.5 μm, apex rounded, base truncate; mean conidium length/width ratio = 8.2:1.

On *Dracophyllum arboreum* Ckn.
Specimen examined: New Zealand, Chatham Islands, Rekohu, Taiko Camp, 8.III.1983, E. H. C. McKenzie (PDD 52058 - **holotype**).

The specific epithet refers to the southern hemisphere situation of the type locality.

Chalara australis resembles both *C. hughesii* Nag Raj & Kendrick in Nag Raj & Hughes (1974) and *C. alabamensis* Morgan-Jones & Ingram (1976). However, *C. australis* has larger conidiophores and conidia than *C. hughesii*, and exhibits a gradual, rather than abrupt transition from venter to collarette. There is a gradual transition in *C. alabamensis*, but the conidia of this species are smaller than those of *C. australis*.

Chalara distans McKenzie sp. nov. Fig. 1B

Coloniae inconspicuae, effusae. Mycelium extermum, ex hyphis brunneis, ramosis, laevibus, septatis, 1.5-2.5 μm crassis. Conidiophora macronematosa, mononematosa, singula, eramosa, erecta, recta vel parum curvata, laevia, 1-3 septata, pallide-brunnea, 60-100 μm longa. Cellulae conidiogenae monophialidicae, in conidiophoris incorporatae, terminales, lageniformes, (37-) 60-80 μm longae; venter subcylindricus (12-) 20-30 (-34) x 6-10 μm; collum cylindricum, (25-) 35-50 (-55) x (2.75-) 3-4 (-4.5) μm; transitio e ventre ad collum gradata vel interdum abrupta; ratio longitudinis mediae colli et ventris = 1.7:1. Conidia endogena, catenulate extrusa, hyalina, cylindrica, laevia vel minute verruculosa, 1-septata, (17-) 18-22 (-23) x (2.5-) 3 (-3.5) μm, apice rotundato, basi truncata; ratio conidii long./lat. = 6.3:1.

In foliis dejectis epacridaceae speciei Dracophylli arborei Ckn.
Holotypus PDD 49389.

Colonies inconspicuous, effused, brown, with white layer of conidia. Mycelium superficial, brown, branched, smooth, septate, 1.5-2.5 μm thick. Conidiophores macronematous, mononematous, single, unbranched, erect, straight or slightly curved, smooth, 1-3 septate, pale brown, 60-100 μm long (including conidiogenous cell). Conidiogenous cells monophialidic, integrated, terminal, lageniform, (37-) 60-80 μm long; venter subcylindrical, (12-) 20-30 (-34) x 6-10 μm; collarette cylindrical, (25-) 35-50 (-55) x (2.75-) 3-4 (-4.5) μm; transition from venter to collarette gradual or occasionally abrupt; ratio of mean lengths of collarette and venter = 1.7:1. Conidia endogenous, extruded in long chains, hyaline, cylindrical, smooth or slightly verruculose, medianly 1-septate, (17-) 18-22 (-23) x (2.5-) 3 (-3.5) μm, apex rounded, base truncate; mean conidium length/width ratio = 6.3:1.

On *Dracophyllum arboreum* Ckn.
Specimen examined: New Zealand, Chatham Islands, Rekohu, Taiko Camp, 8.III.1983, E. H. C. McKenzie (PDD 49389 - **holotype**).

The specific epithet refers to the geographical remoteness of the type locality.

In its morphology *Chalara distans* clearly differs from described species of *Chalara*.

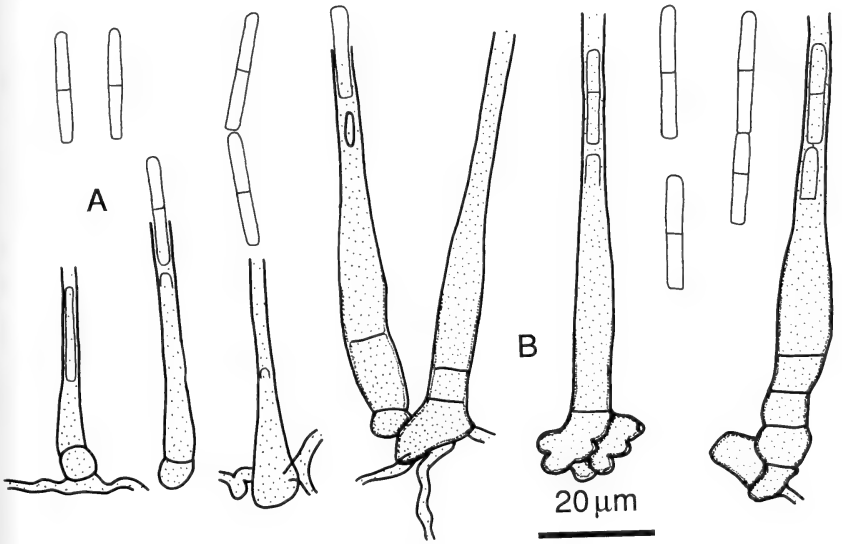


Figure 1 A, *Chalara australis*, conidiophores and conidia (PDD 52058 - type). B, *C. distans*, conidiophores and conidia (PDD 49389 - type). Specimens mounted in hydrous lactophenol.

Circinotrichum chathamiensis McKenzie sp. nov. Fig. 2A

Coloniae amphigenae, punctiformes vel effusae, nigri vel grisei. Mycelium partim intermum et extermum, ex hyphis pallide-brunneis, ramosis et anastomosantibus, laevibus, septatis, 2-4 µm crassis. Setae steriles, simplices, erectae, rectae vel flexuosae, plerumque laeves, septatae, atro-brunneae, apice versus pallidiores, usque ad 330 µm altae, ad basem 5-7.5 µm latae, ad apicem 1.5-3 µm latae. Cellulae conidiogenae polyblasticae, percurrentes visu, discretae, obclavatae vel lageniformes, subhyalinae, 7-12 µm altae, 3-4 µm latae. Conidia acrogenosa, hyalina, adherentia, leniter curvata vel falcata, laevia, eseptata, 20-24 (-26) x 1.5-2 (-2.25) µm.

In foliis dejectis myrsinaceae speciei Myrsinae chathamicae F. Muell. Holotypus PDD 49391.

Colonies amphigenous, punctiform to effused, black when sterile, grey when sporulating. Mycelium partly immersed and partly superficial, pale brown, branched and anastomosing, sometimes aggregated into a pseudoparenchymatous layer, smooth, septate, 2-4 μm thick. Setae sterile, originating from dark brown, thick-walled, swollen cells of the superficial mycelium, simple, erect, straight or flexuous, usually smooth but sometimes minutely verruculose, septate, dark brown, paler towards the apex, up to 330 μm high, 5-7.5 μm wide at the base, gradually tapering to a width of 1.5-3 μm at the apex. Conidiogenous cells polyblastic, apparently percurrent, discrete, obclavate to lageniform, subhyaline, 7-12 μm high, 3-4 μm wide. Conidia acrogenous, hyaline but adhering together at the base of setae to form a greyish-white mass, slightly curved or falcate, smooth, non-septate, 20-24 (-26) x 1.5-2 (-2.25) μm.

On *Myrsine chathamica* F. Muell.
Specimen examined: New Zealand, Chatham Islands, Rekohu, Taiko Camp, 8.III.1983, E. H. C. McKenzie (PDD 49391 - **holotype**).

The specific epithet refers to the type locality, Chatham Islands.

Sutton (1980) provided a key to eight species of *Circinotrichum*, and since then *C. ponmudiense* Varghese & V. G. Rao (1978), *C. britanicum* Kirk (1981), *C. flagelliforme* Zucconi & Onofri (1986), and *C. cochinense* V.G. Rao & Varghese (1988) have been described. *C. chathamiensis* can be distinguished from other species of *Circinotrichum* by the size and shape of conidia, and by the straight, sterile setae.

Cryptophiale insularis McKenzie sp. nov. Fig. 2B

Coloniae conspicuae, effusae. Mycelium partim intermum et extermum, ex hyphis pallide-brunneis, ramosis et anastomosantibus, laevibus, septatis, 1.5-2.5 μm crassis. Conidiophora setiformia e cellulis atro-fuscis, laevibus, basi inflata, macronematosa, mononematosa, singula, eramosa, erecta, recta vel flexuosa, laevia, septata, atro rubro-brunnea, apicem versus pallidiora, acuta, usque ad 410 μm longa, 6.5-10 μm crassa. Zona conidiogenosa inframediana, scutelliformis, 55-100 μm longa, 15-21 μm crassa, uno ordine phialidum; phialis scutello cellarum sterilium pallide fusco celata; cellulae steriles ca. 4-5 μm longarum, 2-3.5 μm latarum. Cellulae conidiogenae monophialidicae, discretae, cylindricae vel lageniformes, pallide-brunneae, 8-13 μm longae, 2.5-3.5 μm latae. Conidia acrogenosa, hyalina, adherentia, falcata, laevia, 1 septata, (12-) 13-16 (-16.5) x 1-1.5 μm, apice acuta, basi obtusa.

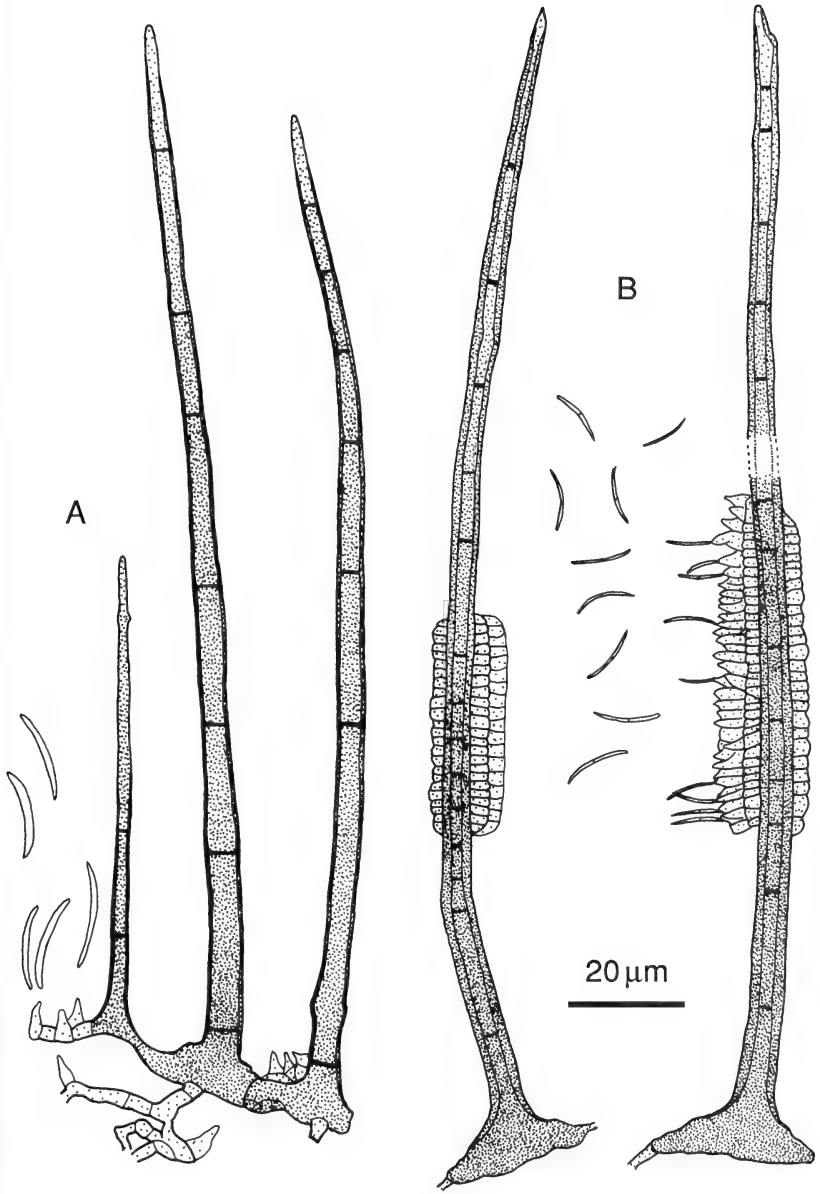


Figure 2 A, *Circinotrichum chathamiensis*, conidiophores and conidia (PDD 49391 - type). B, *Cryptophiale insulare*, conidiophores and conidia (PDD 49399 - type). Specimens mounted in hydrous lactophenol.

In foliis dejectis epacridaceae speciei Dracophylli arborei Ckn. Holotypus PDD 49399.

Colonies conspicuous, effused. Mycelium partly immersed and partly superficial, pale brown, branched and anastomosing, smooth, septate, 1.5-2.5 μm thick. Conidiophores setiform, arising from dark brown, smooth, swollen cells of the superficial mycelium, macronematous, mononematous, single, unbranched, erect, straight or flexuous, smooth, septate, dark reddish-brown, paler towards the acute apex, up to 410 μm long, 6.5-10 μm thick. Conidiogenous zone less than half way up the conidiophore, base to conidiogenous zone 70-105 μm, apex to conidiogenous zone 100-245 μm, zone 55-100 μm long, 15-21 μm wide, consisting of a single row of phialides; phialides obscured by a shield of sterile, pale brown, shield cells; each shield cell ca. 4-5 μm long, 2-3.5 μm wide. Conidiogenous cells monophialidic, discrete, cylindrical to lageniform, pale brown, 8-13 μm long, 2.5-3.5 μm wide. Conidia acrogenous, produced in slime and adhering to the fertile part of the conidiophore in a lateral droplet, hyaline, falcate, smooth, medianly 1-septate, (12-) 13-16 (-16.5) x 1-1.5 μm, acute at the apex, obtuse at the base.

On *Dracophyllum arboreum* Ckn.
Specimen examined: New Zealand, Chatham Islands, Rekohu, Taiko Camp, 8.III.1983, E. H. C. McKenzie (PDD 49399 - **holotype**).

The specific epithet refers to the island nature of the type locality.

In a recent account Sutton et al. (1989) provided a key to nine species of *Cryptophiale*, a tenth species, *C. secunda* Kuthubutheen & Sutton, having been previously transferred to *Cryptophialoidea* Kuthubutheen & Nawawi (1987). *C. insulare* can be distinguished from other species by the structure of the conidiophore apex, size of conidia, and position of the conidiogenous zone on the conidiophore. In conidial size it approaches *C. minor* Farr, but the conidia of *C. insulare* are less variable in shape and slightly larger. The conidiophores are also longer, and the conidiogenous zone is in the lower half of the conidiophore, whereas in *C. minor* it is in the upper half.

Acknowledgment

I gratefully acknowledge the assistance of Dr G. Kuschel, in preparation of Latin diagnoses. I thank Professor Gareth Morgan-Jones, Department of Plant Pathology, College of Agriculture, Auburn University, Alabama, USA for critical review of this paper.

References

Kirk, P. M. 1981: New or interesting microfungi III. A preliminary account of microfungi colonizing *Laurus nobilis* leaf litter. *Transactions of*

the British Mycological Society 77: 457-473.
Kuthubutheen, A. J.; Nawawi, A. 1987: *Cryptophialoidea* gen. nov. on decaying leaves from Malaysia. *Transactions of the British Mycological Society 89*: 581-583.
McKenzie, E.H.C. 1991: Fungi of the Chatham Islands. *Mycotaxon 41*: 195-217.
Morgan-Jones, G.; Ingram, E.G. 1976: Notes on hyphomycetes. XII. A new species of *Chalara*. *Mycotaxon 4*: 489-492.
Nag Raj, T.R.; Hughes, S.J. 1974: New Zealand fungi 21. *Chalara* (Corda) Rabenhorst. *New Zealand Journal of Botany 12*: 115-129.
Rao, V.G.; Varghese, K.I.M. 1988: Forest micro-fungi. VI. Three new taxa of hyphomycetes from India. *International Journal of Mycology and Lichenology 3*: 295-301.
Sutton, B. C. 1980: Microfungi from Australian leaf litter. *Proceedings of the Royal Society of Queensland 91*: 11-19.
Sutton, B.C.; Nawawi, A.; Kuthubutheen, A.J. 1989: Additions to *Belemnospora* and *Cryptophiale* from Malaysia. *Mycological Research 92:* 354-358.
Varghese, K. I. M.; Rao, V. G. 1978: Two new setose hyphomycetes from India. *Botaniska Notiser 131*: 215-217.
Zucconi, L.; Onofri, S. 1986: Two new dematiaceous hyphomycetes from tropical forest litter. *Mycotaxon 27*: 147-153.

Note

From 1 July 1992, Department of Scientific and Industrial Research (DSIR) was replaced by a series of Government 'Crown Research Institutes'. Mycological research and Herbarium PDD became part of Landcare Research, but remain at the same physical location. The new mailing address is Manaaki Whenua Landcare Research NZ Ltd, Private Bag 92170, Auckland, New Zealand.

MYCOTAXON

Volume XLVI, pp. 299-305 January-March 1993

CRASSOASCUS, A NEW NONSTROMATIC GENUS IN THE CLYPEOSPHAERIACEAE

J.M. BARRASA, J. CHECA

Departamento de Biología Vegetal, Universidad de Alcalá de Henares, Madrid, Spain

A.T. MARTÍNEZ

Centro de Investigaciones Biológicas, Consejo Superior de Investigaciones Científicas, Velázquez 144, E-28006 Madrid, Spain

SUMMARY

The monotypic genus *Crassoascus* is described based on *Crassoascus fusisporus* sp. nov. This unitunicate ascomycete is distinguished by the five-celled ascospores in thick-walled asci, with a conspicuous pulvillus and strongly amyloid apical ring, formed in a short beaked ascomata without stromatic or clypeate structures.

INTRODUCTION

During a survey of lignicolous Pyrenomycetes from the Natural Park of Monfragüe (Cáceres, Spain), a nonstromatic xylarean fungus with five-celled ascospores and germ pores in both ends was found under bark of dead branches of *Erica arborea* L., and studied in pure culture.

The presence of a papillate ascoma, a conspicuous pulvillus in the asci, multiseptate ascospores with pallid end cells and terminal germ pores, justify its inclusion in the family Clypeosphaeriaceae Winter.

Eriksson & Hawksworth (1990) considered Amphisphaeriaceae Winter as a large family including 31 genera. However, Barr (1990) resurrected the family Clypeosphaeriaceae for some previous members of Amphisphaeriaceae, and only seven genera, based on ascomata configuration, ascospore morphology and unknown anamorphic states, were included. Barr's concept have been recently accepted by Eriksson & Hawksworth (1991) and is used in the present paper.

Hyaline or brown 1-2 septate ascospores are common in the family but no one genus has been described with four-septate ascospores and germ pores in both ends. Several septate, but hyaline ascospores have been described in the genus *Saccardoella* Speg.

Germ pores are frequent in the family, mainly in members with brown ascospores, but only in the genus *Pseudovalsaria* Spooner germ pores are terminal. By contrast, are rare in Amphisphaeriaceae, and were only reported in *Amphisphaerella* (Sacc.) Kirschst., scattered or in the equatorial band (Barr, 1990), and inconspicuous and terminal in *Pestalosphaeria* Barr (Barr, 1975).

Lepteutypa Petrak, a member of Amphisphaeriaceae, shows similar ascospores to the new genus proposed, however these are three septate, without germ pores and surrounded by a narrow hyaline or brownish coating and may be angular or ornamented (Shoemaker & Müller, 1965; Samuels et al., 1987). Furthermore, the new genus *Ascotaiwania* proposed by Sivanesan & Chang (1992) and included in the family Amphisphaeriaceae, shows a well-developed pulvillus and similar ascospore morphology. Finally, some shape resemblances can be observed in the ascospores of *Rhynchosphaeria irpex* (Berk. et Br.) Berl., an *incertae sedis* unitunicate ascomycete (Eriksson & Hawksworth, 1991) described and illustrated by Berlese (1894), but the long-beaked perithecia constitute the most remarkable difference with the new taxon proposed.

MATERIALS AND METHODS

The fungus was collected from dead branches of *Erica arborea* L. in the Monfragüe Natural Park (Cáceres, Spain) during the summer of 1989.

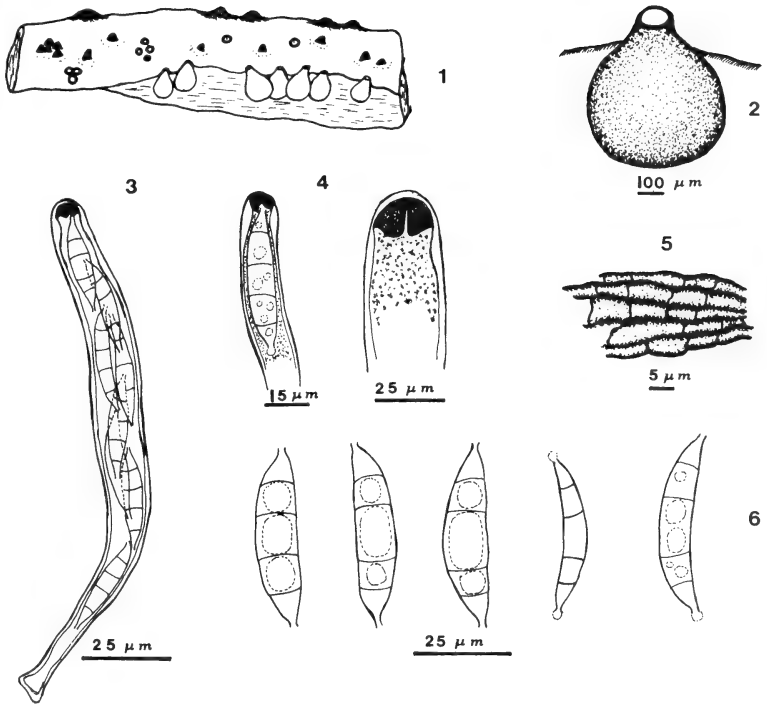
Pure cultures were attempted from single and mass ascospores inoculated on several media: PDA (Bacto-potato-dextrose agar Difco) with 50 ppm chloramphenicol, MEA (2% malt extract, 2% glucose, 0,1% peptone, and 2% agar), and DPYA (0,5% glucose, 0,1% peptone, 0,1% ammonium nitrate, 0,1% potassium hydrogen phosphate, 0,05% magnesium sulfate, 0,001% ferric chloride, 0,2% yeast extract, 0,5 oxgall, 0,1% sodium propionate, 2% agar) (Papavizas and Davey 1959) with 50 ppm of oxytetracycline HCl. All media were incubated at 24°C, under natural dark-light alternances and UV irradiation to stimulate conidial sporulation. However, no coelomycetous anamorph, characteristic of Amphisphaeriaceae, were obtained and only an *Alternaria* anamorph, mostly corresponding with members of Pleosporaceae, were observed on some isolation dishes on MEA after 1 week in culture.

Dry material of *C. fusisporus* is deposited in the herbarium of Alcalá de Henares University (HAH) and the herbarium of the Botanical Garden of Madrid, Spain (MA-Fungi). The isolate of *Alternaria* is deposited in the culture collections of the Centro de Investigaciones Biológicas, Consejo Superior de Investigaciones Científicas, Madrid, Spain (IJFM).

DESCRIPTION

Crassoascus Checa, Barrasa & Martínez gen. nov.

Ascomata globosa, papillata, ostiolata, erumpentia. Asci cylindrici, unitunicati, crasso pariete, annulus apicalis amyloideus, pulvillus non quitinoide. Ascosporae biseriatae,

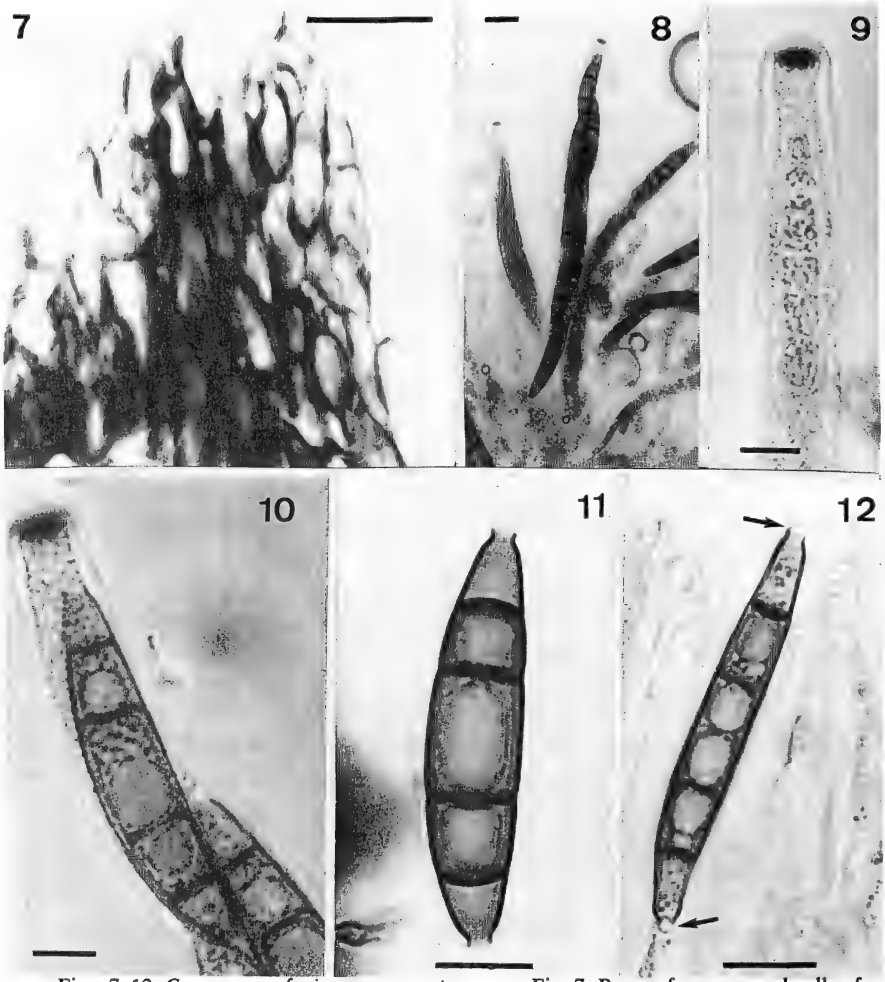


Figs. 1-6. *Crassoascus fusisporus* gen. et sp. nov. Fig. 1. Ascomata on wood. Fig. 2. Wide-ostiolate ascoma. Fig. 3. Ascus with biseriate ascospores. Fig. 4. Asci with apical apparatus, large pulvillus and thick walled. Fig. 5. Rows of compressed cells of peridium. Fig. 6. Spores.

fusiformes, fuscae, leves, tetraseptatae, cellulae terminales cum poro germinationis.

SPECIES TYPICA: *Crassoascus fusisporus* Checa, Barrasa & Martínez sp. nov.

Stromatic tissues lacking. Ascomata subcorticolous, erumpent, sphaeroid or globose,separate or gregarious; apex papillate to short beaked, broadly ostiolate; papilla bearing small, dark and protruding cells; ectal peridium constituted by rows of compressed brown cells and inner peridium by pseudoparenchymatic hyaline cells. Asci cylindrical, thick walled, 8-spored; apical ring enlarged, amyloid, with a large pulvillus. Paraphyses narrow. Ascospores biseriate, clear brown, fusoid, asymmetric, 5-celled, guttulate when young, smooth-walled, apiculate ends with a conspicuous germ pore.



Figs. 7-12. *Crassoascus fusisporus* gen. et sp. nov. Fig. 7. Rows of compressed cells of peridium. Fig. 8. Ascus with biseriate ascospores. Figs. 9 and 10. Thick-walled asci with apical apparatus. Figs. 11 and 12. Four-septate spores showing terminal germ pores (arrows, papillate ends). Scale bars= 10 µm.

TYPE SPECIES: *Crassoascus fusisporus* Checa, Barrasa & Martínez sp. nov.

ETYMOLOGY: Latin, *crassus*= thick, *ascus*= ascus, referring to the thick walled asci.

Crassoascus fusisporus Checa, Barrasa & Martínez sp. nov. Figs. 1-12

Ascomata erumpens, dispersa o gregaria, papillata, ostiolata, sphaerica, 500-600 x 300-400 µm. Peridium duplex. Paraphyses angusta. Asci cylindrici, 140-150 x 15-20 µm, stipites usque ad 45 µm longes. Ascosporae biseriatae, tetraseptatae, non constrictae, fuscas, levis, fusiformes-naviculares, 40-45 x 8-10 µm, cellulae terminales apiculata cum poro germinalis, utrinque cum parva papilla hyalina evanescentes.

HABITAT: Species lignicola, nascitur in ramis dejectis *Ericae arboreae* L. collecto in colle Cañadillae (Monfragüe, Cáceres) Hispaniarum, leg. J. Checa, J.M. Barrasa et M.N. Blanco, 21-VI-1989.

HOLOTYPUS: MA-Fungi 26331.

Stromatic tissues lacking. Ascomata separate or gregarious, nonclypeate, subcorticolous, erumpent, 500 - 600 x 300 - 400 µm, (Figs. 1 and 2); double peridium: ectal cells in rows of compressed brown cells, 7 - 8 x 5 - 7 µm (Figs. 5 and 7); inner cells hyaline, isodiametrical, 7 - 8 µm diameter, with several guttules. Asci cylindrical (Fig. 3), subapically thickened (Figs. 4 and 9), 140 - 150 x 15 - 20 µm, stipe 45 µm long, apical annulus enlarged, 8 - 10 µm wide, amyloid and nonchitinoid, pulvillus refringent (Figs. 9 and 10). Paraphyses numerous and narrow. Ascospores 40 - 45 x 8 - 10 µm, biseriate (Figs. 3 and 8), clear brown, fusoid, asymmetric, smooth-walled, four septate, nonconstricted, apiculate at both ends with a conspicuous terminal pore (Figs. 6 and 11), young ascospores with 1-2 guttules in each cell and a fugaceous hyaline papilla at the spore tips (Figs. 6 and 12).

HABITAT: On dead branches of *Erica arborea* L., collected in Puerto de la Cañadilla, Natural Park of Monfragüe (Cáceres, Spain) (21 June 1989).

HOLOTYPE: MA-Fungi 26331. Isotype: H.A.H. 12661-12665/92.

ETYMOLOGY: From Lat. *fusus*= spindle, *spora*= spore, referring to the spore shape.

DISCUSSION

The genus *Crassoascus* is a member of the functionally unitunicate ascomycetes showing an enlarged pulvillus and amyloid apical ring in the ascus apex, even though the asci are thick walled or morphologically bitunicate. Studies in TEM revealed that the main difference between unitunicate and bitunicate asci is referred to the functionallity, while a gradual morphology variation has been observed (Eriksson, 1981).

Crassoascus is, probably, a member of Clypeosphaeriaceae, however the presence of a nonstromatic, nonclypeate, short-necked ascomata, and strongly amyloid apical ring in the ascus are frequent features in Amphisphaeriaceae. Some genera of Amphisphaeriaceae were transferred to Clypeosphaeriaceae (Barr, 1989) being the main characteristics of the latter, the presence of a stout (often clypeate) papilla or a beak in the ascomata, a large and non-amyloid apical ring in the asci and pores or germ slits at one or both ends of the ascospores (Barr, 1990).

Several spore characteristics of *Crassoascus fusisporus*, viz. the pale brown pigmentation, the conspicuous terminal germ pore in each tips or, even, the presence of a small, fugaceous terminal hyaline appendage at each end of the spore, seem to indicate close relationships with the Clypeosphaeriaceae. The habit of growth of the new fungus, growing on decorticated wood, is also in concordance with a number of members of the Clypeosphaeriaceae, in contrast with Amphisphaeriaceae, typically developing on periderms and leaves of various plants. A large and conspicuous pulvillus in the ascus apex has been frequently described in members of Clypeosphaeriaceae, but the strongly amyloid apical ring

is the most striking feature in the family. However, a positive iodine reaction was also detected in the annulus of the asci of *Clypeosphaeria americana* Barr & Samuels and in some collections of *Clypeosphaeria mamillana* (Fries) Lambotte (Barr, 1989).

Furthermore, a coelomycetous state of *C. fusisporus* was not obtained in pure culture. Anamorphs producing acervuli and pycnidia have been described in Amphisphaeriaceae, but are scarcely known in Clypeosphaeriaceae (Barr 1990). Only an *Alternaria* anamorph was obtained in several Petri dishes, but uncertain relationships with *C. fusisporus* can be established and the chance of a contamination from the isolation cannot be rejected. Moreover, *Alternaria* have been reported for a number of members of bitunicate ascomycetes (Arx & Müller,1975; Arx,1981), mainly included in Pleosporaceae Wint., but never described in Xylariales Nannfeldt. The absence of an anamorphic state, that might shed light on relationships, reinforce the inclusion of this new fungus in Clypeosphaeriaceae.

The recently proposed genus *Ascotaiwania* A. Sivanesan & H.S. Chang, described on the basis of *A. lignicola*, growing on dead wood, and included in the family Amphisphaeriaceae by Sivanesan & Chang (1992), seems to be a related genus and could be considered its inclusion in Clypeosphaeriaceae. However, the presence of an oblique or horizontal perithecia, asci with a non-amyloid apical ring and larger and 7-septate pigmented ascospores with hyaline end cells without germ pores, constitute significant differences with the new genus proposed here.

The fungi associated with mediterranean vegetation have not been extensively studied and, consequently, the morphological features of the teleomorph of *C. fusisporus* conform a species with a rather difficult taxonomic treatment.

ACKNOWLEDGEMENTS

We are grateful to Dr. O. Eriksson (University of Umeå, Sweden) for examination of material and valuable comments, and to Dr. M.E. Barr (University of Massachusetts, U.S.A.) by reading the manuscript and helpful suggestions. This research has been supported by the Spanish C.A.I.C.Y.T. (PA86-0063).

LITERATURE CITED

ARX, J.A, von. 1981. The genera of the fungi sporulating in pure culture. J. Cramer.

ARX, J.A., von & E. MÜLLER. 1975. A re-evaluation of the bitunicate Ascomycetes with keys to families and genera. Stud. Mycol. 9: 1-159

BARR, M.E. 1975. *Pestalosphaeria*, a new genus in the Amphisphaeriaceae. Mycologia 67: 187-194.

BARR, M.E. 1989. *Clypeosphaeria* and the Clypeosphaeriaceae. Systema Ascomycetum 8: 1-8.

BARR, M.E. 1990. Prodromus to nonlichenized, pyrenomycetous members of class Hymenoascomycetes. Mycotaxon 39: 43-184.

BERLESE, A.N. 1894. Icones fungorum ad usum sylloges Saccardianae accomodatae. vol.

1. Pyrenomycetes. Biblioth. Mycol. J. Cramer (Reprint 1968).

ERIKSSON, O. 1981. The families of bitunicate ascomycetes. Opera Botanica 60: 1-209.

ERIKSSON, O.E. & D.L. HAWKSWORTH. 1990. Outline of the ascomycetes -1989-Systema Ascomycetum 8: 119-318.

ERIKSSON, O.E. & D.L. HAWKSWORTH. 1991. Outline of the ascomycetes -1990-Systema Ascomycetum 9: 39-271.

PAPAVIZAS, G.C. & C.P. DAVEY. 1959. Evaluation of various media and antimicrobial agents for isolation of soil fungi. Soil Sci. 88: 112-117.

SAMUELS, G.J., MüLLER & O. PETRINI. 1987. Studies in the Amphisphaeriaceae (sensu lato) 3. New species of *Monographella* and *Pestalosphaeria*, and two new genera. Mycotaxon 28: 472-499.

SHOEMAKER, R.A. & E. MÜLLER. 1965. Types of the pyrenomycete genera *Hymenopleella* and *Lepteutypa*. Can. J. Bot. 43: 1457-1460.

SIVANESAN,A. & H.S. CHANG. 1992. *Ascotaiwania*, a new amphisphaeriaceous ascomycete genus on wood from Taiwan. Mycol. Res. 96: 481-484.

MYCOTAXON

Volume XLVI, pp. 307-313 January-March 1993

A NEW SPECIES OF *SPIROMASTIX* FROM AFRICA

[1]J. GUARRO, J. GENE and [2]CH. DE VROEY

[1]Unitat de Biologia i Microbiologia, Facultat de Medicina, 43201 Reus, Tarragona, Spain.[2]Laboratory for Mycology, Institute of Tropical Medicine 'Prince Leopold', Nationalestraat 155, B-2000 Antwerpen, Belgium.

ABSTRACT

***Spiromastix tentaculatum* n. sp.** (Gymnoascaceae, Eurotiales) is characterized by the undulate peridial appendages with inflated ends and ascospore walls with irregularly pitted furrows. A key to the genus is given.

Key words: Gymnoascaceae, ***Spiromastix tentaculatum***, ***Spiromastix grisea***, ***Spiromastix warkupii***.

INTRODUCTION

The genus ***Spiromastix*** Kuehn & Orr (Gymnoascaceae, Eurotiales) is based on an isolate from an Australian soil, and until recently it was only represented by the type species, ***S. warcupii*** Kuehn & Orr (1962). A second species was described by Currah and Locquin-Linard (1988) from gazelle dung collected in central Sahara. Recently we had the opportunity to examine four strains of ***Spiromastix*** from African soils. Two of them are identical to the type species, of which only the holotype was known, and the others belong to a new species. Its main features are described in the present paper.

MATERIAL AND METHODS

The fungi were isolated in Antwerp from soil samples collected in Africa, with the spray technique of Orr (Kuehn *et al.* 1961).

TAXONOMY

Spiromastix tentaculatum Guarro, Gené et de Vroey, **sp. nov.** Figs. 1-11
(Etym: appendages resembling squid tentacles = latin, *tentaculum*)

Ascomata discreta, aurantiacea vel brunnea, plus minusve globosa, solitaria, rare gregaria, 45-70 μm diametri. Hyphae peridiales brunneae, laeviae, leviter septatae, contortae, irregulariter ramosae, parietibus crassis, et inter et circum ascosporarum reticulum formantes; appendices brunnei, 1-1.3 μm diametri, cum extrema singularia et tumida, 2-3(4.5) μm diametri, leves, non ramosi, parietibus crassis, non septatis, leviter curvi vel undulati, nunquam spira efformantes. Asci subglobosi, ovati vel ellipsoidei, octosporati, evanescenti, 7.5-8 x 5-6 μm. Ascosporae pallidae-brunneae, oblatae, 2.5-3.5 x 2-2.2 μm, laeviae vel modice foveolatae, a SEM irregulariter cavatae et leviter striatae. Coloniae (OMA) ad 25°C fere lente crescunt, candidae vel luteolae, gossypinae, reverso incolorato vel diluto-brunneo; ad 37°C magis celeriter crescunt. Status asexualis ignotus.

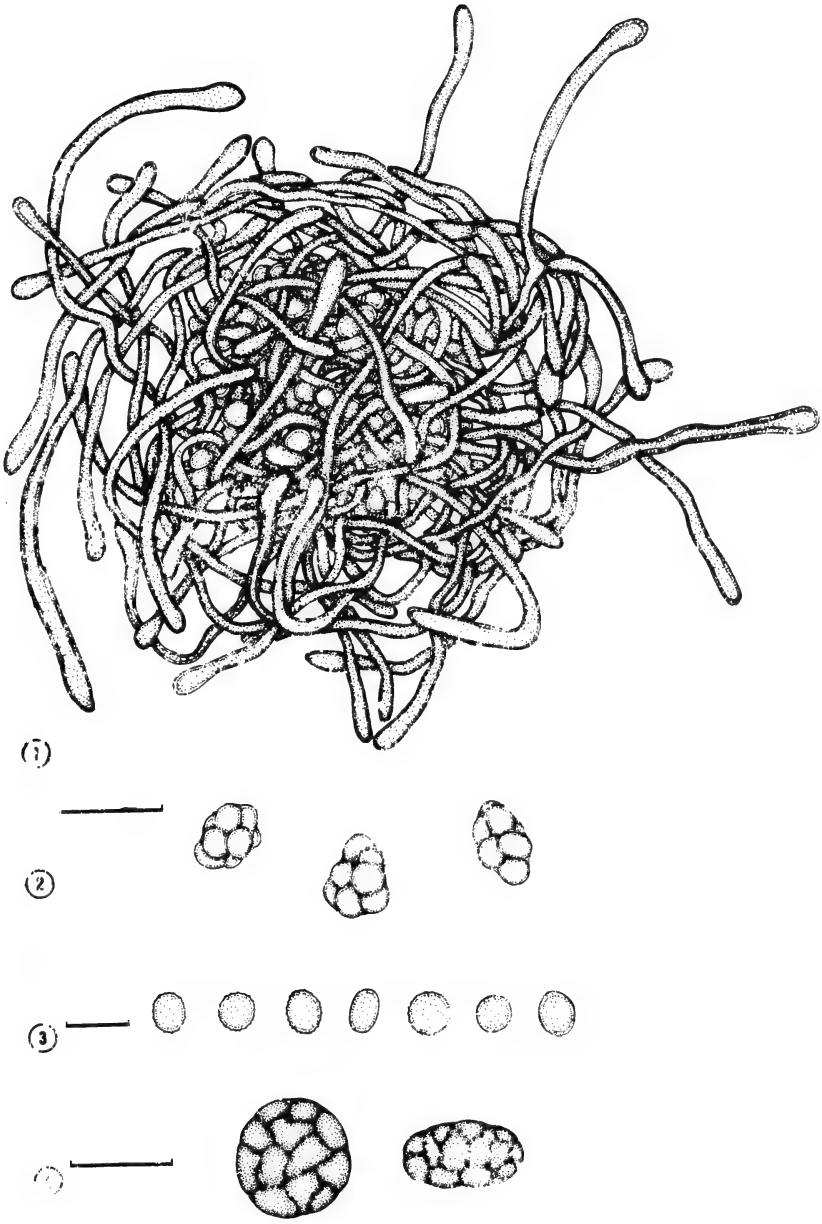
Cultura typica: IMI 351264 *ex solo*, 1966. **Isotypus** FMR* 3842.

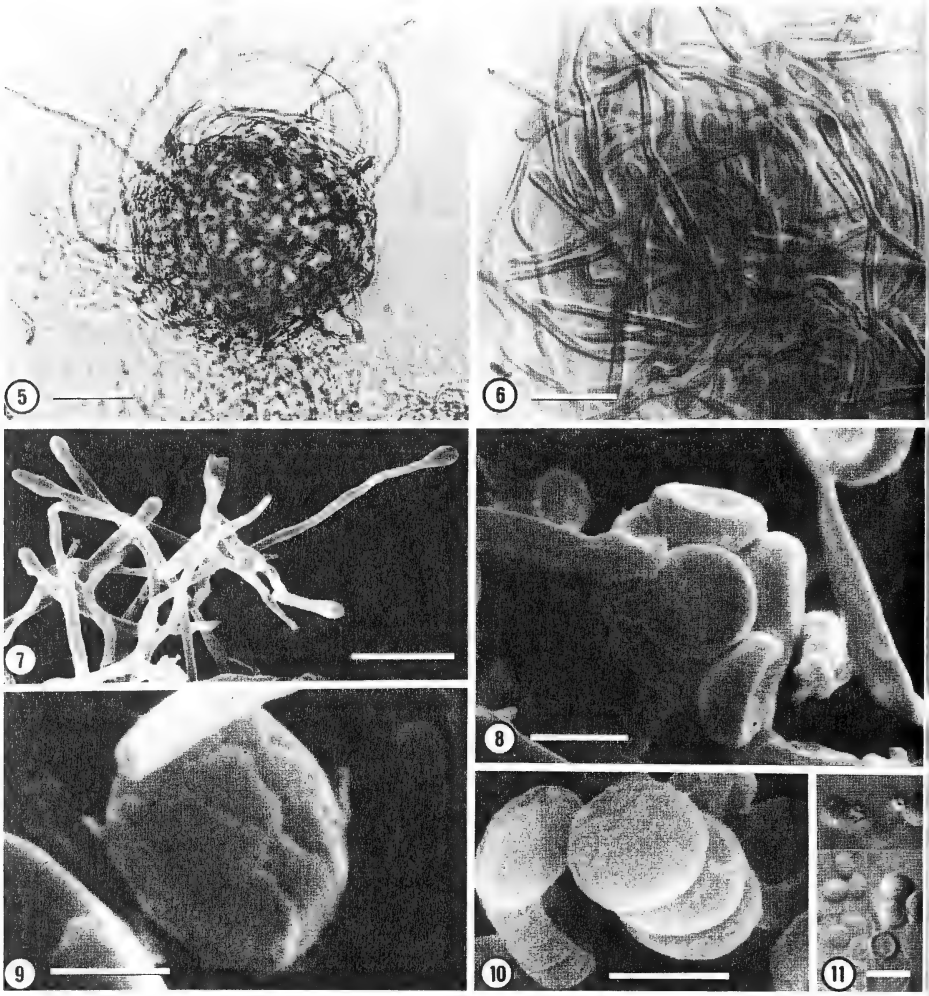
Ascomata discrete, brownish-orange to mid brown when mature, globose to subglobose, 45-70 μm diam., single, occasionally in clusters (Figs. 1,5). **Peridial hyphae** brown, thick-walled, smooth, sparsely septate, contorted, forming a loose mesh around and among the ascospores; appendages arising from peridial hyphae and extending outwards, brown, aseptate, simple, thick-walled, smooth, slightly curved or wavy, never helical, 1-1.3 μm diam., frequently with swollen ends 2-3(4.5) μm diam (Figs. 6,7). **Asci** subglobose or ovoid to ellipsoid, 8-spored, hyaline, evanescent, 7.5-8 x 5-6 μm (Figs. 2,8). **Ascospores** pale brown, oblate, 2.5-3.5 x 2-2.2 μm, under SEM several irregularly pitted furrows are observed (Figs. 4,9,10), smooth or slightly punctate, sometimes slightly echinulate with the light microscope (Figs. 3,11). Anamorph unknown.

Colonies on oat-meal agar (OMA) reaching 18-26 mm diam. in 24 days at 25°C,

*FMR, Herb. mycol. from the Facultat de Medicina, Reus, Spain.

Figs. 1-4. ***Spiromastix tentaculatum*** (IMI 351264). Fig. 1, ascoma (bar=10 μm). Fig. 2, asci (bar=10 μm). Fig. 3, ascospores under light microscope (bar=5 μm). Fig. 4, tracing of ascospores from SEM. (bar=2 μm).


(1)
(2)
(3)
(4)



Figs. 5-11. ***Spiromastix tentaculatum*** (IMI 351264). Fig. 5, ascoma (bar=10 μm). Figs. 6, 7, peridial appendages (bar=10 μm). Fig. 8, ascus (bar=2 μm). Figs. 9-11, ascospores (Fig. 9, bar=1 μm; Fig. 10, bar=2 μm; Fig. 11, bar=5 μm).

yellowish-white at the centre, white at the periphery, superficial mycelium cottony and slightly raised at the centre, felty at the periphery, margin regular and defined, reverse colourless to pale brown; at 37°C colony growth is faster (35-40 mm in 24 days), with similar morphology as above but the reverse is pale brown at the centre. The ascomata appear at this time at both temperatures.

On Sabouraud diluted 1/10 + salts (Takashio, 1973) the colonies are 19-23 mm diam. in 24 days, white to yellowish grey, felty to floccose, slightly raised at the centre and flat at the periphery with some radial folds, margin slightly undulate and defined, reverse greyish yellow; reaching 37-38 mm diam. in 24 days at 37°C but the colonies have practically the same features as on OMA; the ascomata are abundant under these conditions.

On phytone yeast extract agar (PYE) at 25°C the colonies reach 13 mm in 24 days, yellowish white, waxy, slightly floccose, hemispherical, rugose, margin undulate, reverse pale brown. Ascomata on PYE were not detected.

Material examined.- ***Spiromastix tentaculatum***: IMI 351264 (**Holotype**) (Cultures ex holotype: RV* 24167, CBS 184.92, FMR 3842), isolated from a soil sample collected by J. Bosmans in the province of Hiran, Somalia, Mar. 1966; FMR 3841 (=RV 24211), isolated from a soil sample collected by J. Bosmans in Burao, Somalia, 1966. ***S. warcupii***: IMI 351265 (=RV 24816, CBS 185.92, FMR 3843), isolated from a soil sample (chicken yard) collected by P. Dockx in Burundi, Jun. 1968; IMI 351266 (=RV 24852, CBS 186.92, FMR 3844), isolated from a soil sample collected by D. Thienpont in Makassar, Sulawesi, Apr. 1968.

KEY TO THE SPECIES OF *SPIROMASTIX*

1a. Ascomata bearing undulate appendages with swollen ends . . . . . ***S. tentaculatum***

1b. Ascomata with helical appendages 2

2a. Helical appendages with 1-2 turns. Ascospores punctate all over the surface . . . . . ***S. warcupii***

2b. Helical appendages with 2-8 turns. Ascospores smooth and pitted along the equatorial zone . . . . . ***S. grisea***

*RV, Herb. mycol. from the Institute of Tropical Medicine, Antwerpen, Belgium.

DISCUSSION

Von Arx (1987), in his re-evaluation of the Eurotiales, placed ***Spiromastix*** in an uncertain position but suggested its inclusion in the Gymnoascaceae *sensu* von Arx. We think ***Spiromastix*** exhibits the typical characteristics of this family, e.g. ascospores discoid or lenticular, usually smooth, and ascomata without a wall of flattened cells. According to von Arx (1987) the ascospores of the Gymnoascaceae never have reticulate or pitted walls, but this is not always true because ***Spiromastix*** and some species of ***Gymnoascus*** Baranetzky (Cano & Guarro, 1989) show minutely pitted ascospores. The similarities of that genus with ***Gymnoascus*** are very close, both having oblate pigmented ascospores; the only difference is in the presence of thick-walled appendages in ***Spiromastix*** which are absent in the other. The anamorphs are lacking in ***Spiromastix*** and only occasionally present in ***Gymnoascus***.

The species of ***Spiromastix*** are differentiated mainly on the characteristics of the peridium; the ascospores are very similar in size in all of them but with some differences in the distribution of pits on their surface. The typical appendages of ***S. tentaculatum***, with inflated ends, are unique for the genus and family. Piontelli and Toro (1987) described and illustrated a fungus from hair of wild rabbit in Chile, which seems identical to ***S. tentaculatum***. They identified it as an atypical ***S. warcupii***. ***S. grisea*** Currah & Locquin-Linard and ***S. warcupii*** have a loose mesh-like peridium of thin-walled hyphae from which emerge thick-walled, helical appendages. In ***S. tentaculatum*** the hyphae of the peridium are thick-walled and have the same characteristics as the appendages.

ACKNOWLEDGEMENTS

This work was supported by grant nº 92/0785 from FIS from the Ministerio de Sanidad y Consumo, Spain. We are very grateful to Dr. E. Descals (C.S.I.C.) for reviewing this article.

REFERENCES

ARX, J. A. VON. 1987. A re-evaluation of the Eurotiales. *Persoonia* **13**: 273-300.

CANO, J., and GUARRO, J. 1989. Two new keratinophilic Ascomycetes from Spain. *Stud. Mycol.* **31**: 61-67.

CURRAH, R. S., and LOCQUIN-LINARD, M. 1988. ***Spiromastix grisea*** sp. nov. and its relationships to other Onygenaceae with helical appendages. *Can. J. Bot.* **66**: 1135-1137.

KUEHN, H. H., and ORR, G. F. 1962. A new species of Gymnoascaceae. *Mycologia* **54**: 160-167.

KUENH, H.H., ORR, G. F., and GHOSH, G. R. 1961. A new and widely distributed species of ***Pseudoarachniotus***. *Mycopathol. Mycol. Appl.* **14**: 215-229.

PIONTELLI, E. and TORO S.M., M. A. 1987. ***Spiromastix warcupii***, ***Xanthothecium peruvianum***, ***Tolypocladium niveum*** y ***Phialemonum curvatum***. Cuatro aislamientos fúngicos de interés en suelos chilenos II. *Bol. Micol.* **3**: 159-163.

TAKASHIO, M. 1973. Études des phénomènes de reproduction liés au vieillissement et au rajeunessement des cultures de champignons. *Ann. Soc. Belge Méd. Trop.* **53**: 427-580.

MYCOTAXON

Volume XLVI, pp. 315-319 January-March 1993

A NEW SPECIES OF *COMATRICHA* WITH INCOMPLETELY RETICULATED SPORES FROM SPAIN

A. CASTILLO, G. MORENO & C. ILLANA

Departamento de Biología Vegetal (Botánica). Universidad de Alcalá de Henares. Alcalá de Henares, 28871 Madrid. Spain.

Abstract.- ***Comatricha meandrispora* sp. nov.** is described and illustrated with M.O. and S.E.M. photographs. It is characterized by its very distinct spore ornamentation, which consists of fine low, brokenly reticulate – meandering – dark bands.

Key words: *Comatricha meandrispora*, *Myxomycetes*, Spain, taxonomy, chorology.

Comatricha meandrispora Castillo, Moreno & Illana *sp. nov.* (Figs. 1–2)

Sporocarpia siuncta vel glomerata,* 1–1,5 mm *alta, ellipsoidalia vel ovalia, castaneo obscuro colore. Stipes castaneo–ater,* 0,2–0,4 mm *longus. Columella fere usque ad apicem adveniens versus mediam acriter angustior fit figuram rostratam exhibens. Plasmodium ignotum.

Capillitium castaneum, abundans, sinuosum, imperfectam externe reticulatam formam praebens. Sporae sphaericae,* 6–7 μm diam., *ornamento cristato apertum et inaequalem labyrintum typicum constituente.

***Habitat: In mortuo ligno Quercus faginea,* La Fuensaviñan, Guadalajara, leg. A. Castillo, AH 14691 *(Holotypus). Isotypus in herb.* Nannenga–Bremekamp no. 16.755 (slide) *et* BR (Rammeloo, slide)**

Sporocarps scattered or in small groups, stipitate, total height 1–1,5 mm, sporophores ellipsoidal to oval, dark brown. Hypothallus wide brown. Stalk blackish–brown, 0,2–0,4 mm in height. Peridium evanescent but for a persistent membranous collar. Columella extending almost to the apex, where it spits into two (or more) slender capillitium branches or ending bluntly and/or sub–capitately: it has the same width as the stalk below but it narrows rather suddenly 1/3 or 1/2 way up. Plasmodium unknown.

Capillitium slender, dark–brown throughout, dense, flexuose, with rounded axils, almost smooth internally roughned near the periphery, closed on the surface with short free branchlets ends outwards. Spores dark–brown in mass, very pale in transmitted light, globose, 5,5–7 μm in diam., with an ornamentation formed by low, thin, dark bands or strongly broken reticulation, with a few scattered, complete small meshes which form a characteristic irregular open labyrinth (distinct under S.E.M.)

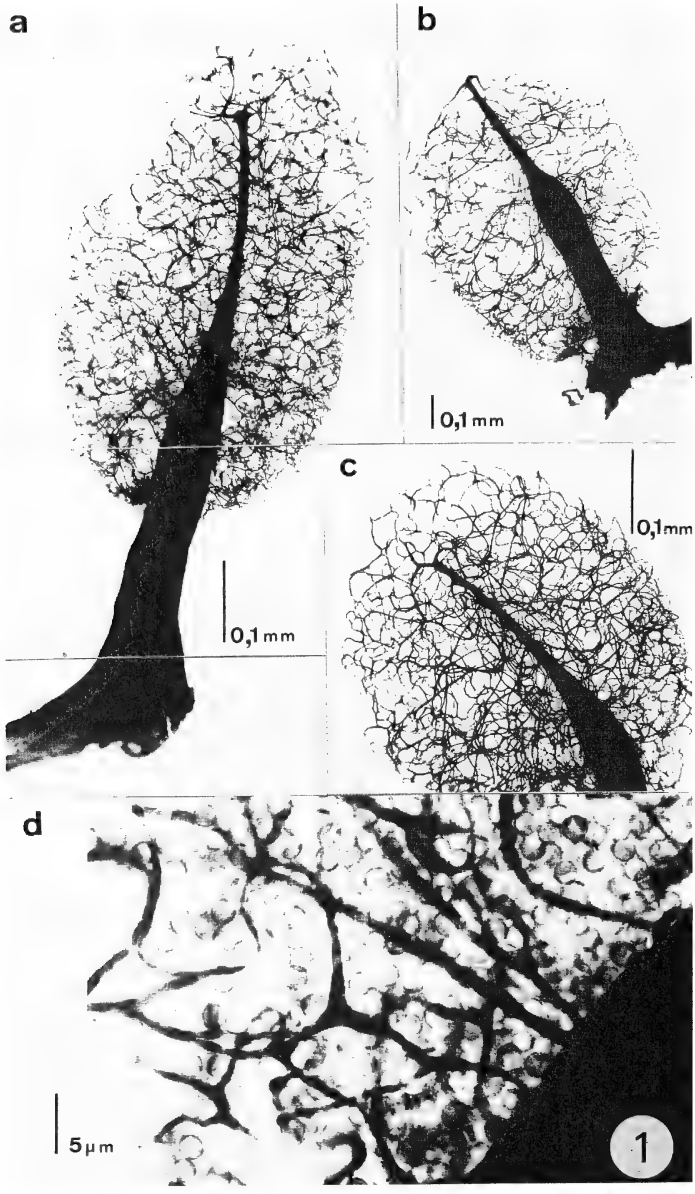


Fig. 1.– ***Comatricha meandrispora*** **sp. nov. (AH 14691,** ***Holotypus*****)**: a y b. Sporocysts; c. Columella and capillitum; d. Capillitium.

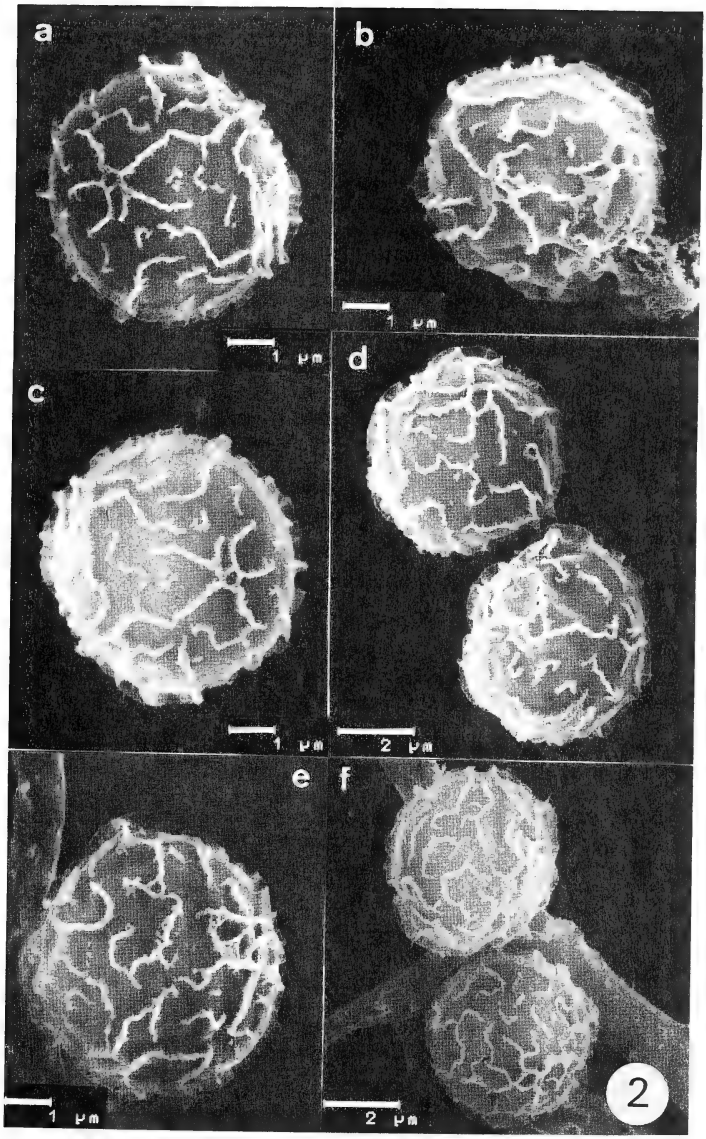


Fig. 2.– ***Comatricha meandrispora*** **sp. nov. (AH 14691,** ***Holotypus*****)**: Spores with critical point method.

Material examined: On wood of *Quercus faginea*, La Fuensaviñan, Guadalajara (1.100 m.), 2.XI.1991, leg. A. Castillo, AH 14691 (*Holotypus*). On wood of *Pinus pinaster*, Riba de Saelices, Guadalajara (1.190 m.), 2.XI.1991, leg. A. Castillo, AH 14945.

Comatricha meandrispora is characterized by its small pale spores with its characteristic meandering dark thin bands, by its sinuous capillitium and by its rostrate columella. The sporal ornamentation may resemble that of some species which have reticulate spores which may be differentiated as follows viz.:

Comatricha anomala Rammeloo, has spores 9–10 μm diam., with groups of small meshes, but the remaining part is just warted, moreover the capillitium is open on the periphery, with long free ends outwards.

Comatricha cylindrica (Bilgram.) T. Macbride, apart from having a spore with incomplete reticulation, has much larger spores and it has a membranous columella and a silvery persistent peridium.

Comatricha orthotricha Bratteng, has globose sporocarps and a very lax capillitium which radiates straight out from columella, sparcely branched dichotomously and with only a few anastomoses (BRATTENG, 1975).

Comatricha reticulata Gilbert, has strongly reticulate spores, 7–9 μm diam, and a capillitium net that suggests *Stemonitis*.

Comatricha reticulospora Ing & Holland, has an irregular columella and its spores are somewhat larger, 6–10 μm in diam., with an ornamentation formed by a complete spinulose-banded reticulum with about 15 meshes to the hemisphere.

Comatricha rispaudii Hagelst., which has a columella which is very irregular and sinuous, dividing quite often near the base into the main branches.

Comatricha subalpina Farr & Stephenson, is close to *Comatricha meandrispora*, with its spores of 6–7 μm in diam. The capillitium has numerous warts, short rods, nodules and many long free rather pale ends on the periphery (FARR, 1987).

ACKNOWLEGMENTS

We wish to express our gratitude to Dr. Rammeloo and Mrs. Nannenga-Bremekamp for the revision and scientific comments. To Mr. A. Priego from the Microscopy Electronics Service of the University of Alcalá de Henares for the photographs.

BIBLIOGRAPHY

BRATTENG, A.S. (1975). Comatricha orthotricha, a new species of Myxomycete. *Mycologia* 67: 413–417.

ING. B. & C. HOLLAND (1967). New species of comatricha and Paradiachea. *Trans. Br. Mycol. Soc.* 50: 685–686.

FARR, M.L. (1987). A new species of Comatricha from Colorado. *Mycotaxon* 30: 455–458.

FARR, M.L. (1988). Notes on Mycetozoa. V. Corrections, redispositions and new taxa. *Int. J. Myc. Lichenol.* 3: 199–213.

PECK, C.H. & H.C. GILBERT (1932). Myxomycetes of northwestern Oregon. *Amer. J. Bot.* 19: 131–147.

MYCOTAXON

Volume XLVI, pp. 321-327 January-March 1993

PHLEBIA PALLIDA IN NORTH AMERICA

J. GINNS

Centre for Land & Biological Resources Research
Agriculture Canada, Wm. Saunders Building
Ottawa, Ontario, K1A 0C6, Canada

Abstract: - The fungus known as *Radulum pallidum* is redescribed and illustrated. The geographic range as reported in the literature is corrected and the epithet is combined in *Phlebia*.

The generic name *Radulum* Fr. was, for over four decades (ca. 1930-1970), used for a group of species in the Hydnaceae *sensu lato* (Basidiomycetes). Miller and Boyle (1943) are an example of authors who so applied the generic name. However, Donk (1956) concluded that the type for the generic name *Radulum* was an Ascomycete. Of the basidiomycete epithets previously assigned to *Radulum* and reported from the United States or Canada, all but *R. pallidum* have been transferred to Basidiomycete genera. The species has not been reexamined since 1943 (Miller and Boyle 1943). Therefore, a detailed description of the fungus is presented, including notes on its habitat and geographic distribution, and the epithet is transferred to an appropriate genus.

METHODS

The standard mounting media for examination of specimens of the Corticiaceae were used, i.e., Melzer's reagent, 2% potassium hydroxide, and cotton blue in lactic acid. The formulae for these can be found in Boidin (1958), Hawksworth *et al.* (1983) and Hjortstam *et al.* (1987). The codes in parentheses represent colours from the *Munsell Book of Color* (Anon., 1929-1942). Abbreviations

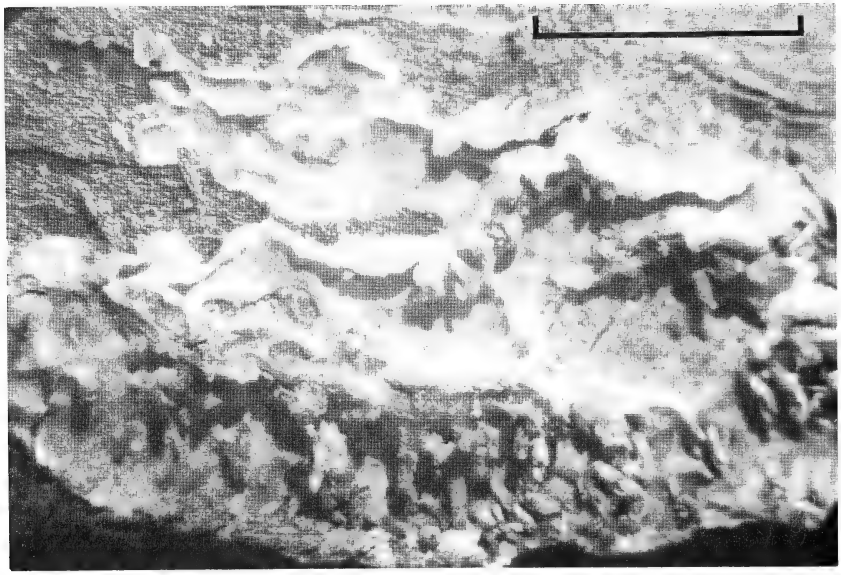
for herbaria where specimens examined are preserved follow Holmgren *et al.* (1990).

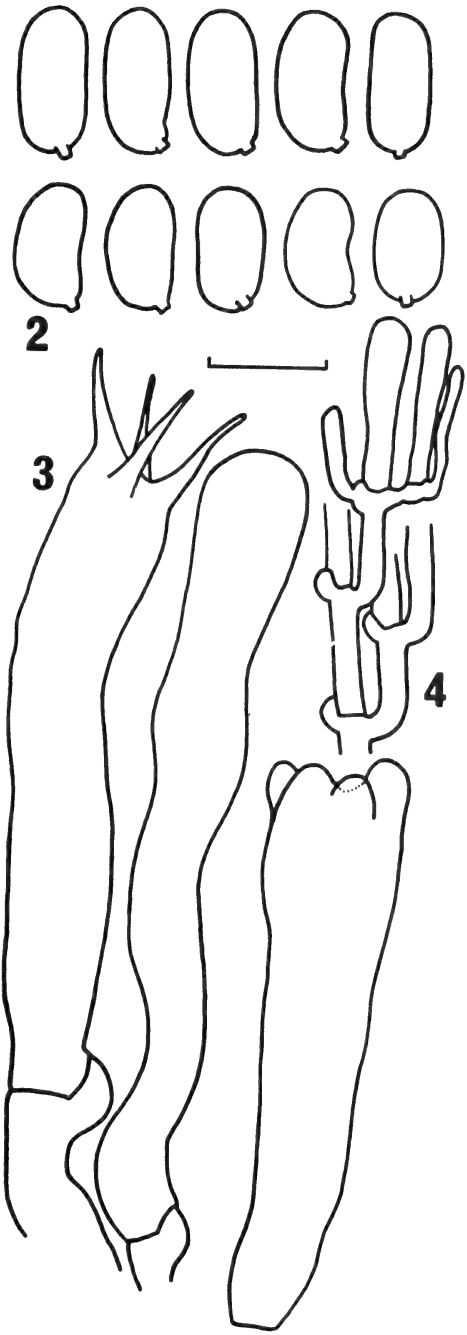
DESCRIPTION

Phlebia pallida (Berk. & Curt.) Ginns, *comb. nov.*
≡ *Radulum pallidum* Berk. & Curt., Grevillea 1:145, 1873.

Basidomes (Fig. 1) typically effuse-reflexed or strictly effuse, circular, 10-40 mm diam, frequently confluent and then larger. Pileus narrow, 1-7 mm deep and 15-40 mm long, sometimes imbricate, the surface cream color, pallid to dirty grey, dull, matted tomentose, sometimes finely radially strigose. Margin pallid, adnate, radially fibrillose to rather thick and determinate, 0.5 mm wide. Hymenial surface pale orange, pale orange-brown, pale brownish yellow, orange-brown (5YR6/6), dark orange-brown, ceraceous to slightly waxy, varying from mostly smooth with few warts to densely raduloid, the largest spines 3 x 0.1 mm, cylindrical, with blunt apices or some with twin

Fig. 1. Basidiome of *Phlebia pallida* showing the small, imbricate pilei and the hymenial surface with some cylindrical spines. From BPI 263456. Scale = 10 mm.





Figs. 2-4. *Phlebia pallida*. Fig. 2. Basidiospores. Fig. 3. Mature basidium and two immature basidia. Fig. 4. Sketch, not to scale, showing the branching pattern of the subhymenial hyphae. From Curtis 2559 (FH). Scale = 5 μm, and applies to 2 and 3.

peaks. Subiculum 630-800 μm thick, white to pallid, firm, not waxy.

Hyphal system monomitic. Subicular hyphae loosely to rather densely woven, distinct, easily separated in squash mounts, with a single clamp connection at each septum, (2.0-) 3-4 (-5) μm diam, the walls thin to 0.5 μm thick, hyaline to slightly refractive, nonamyloid, acyanophilous. Hyphae in the warts and spines similar but longitudinally woven. Hyphae of the pileus surface repent, not differientiated into a surface layer. Hyphae of the pileus context similar to the subiculum but rather loosely woven with large air spaces and a few strands to 30 μm diam. Hymenium and subhymenium 40-100 μm thick, sometimes with numerous, globose granules 0.5 μm diam. Subhymenial hyphae essentially vertically oriented and branched to produce a thickening hymenium (Fig. 4). Cystidia lacking. Hyphidia

few, indistinct, filiform, simple, 2-3 μm diam. Vesicles lacking or scattered in subiculum, globose, 12-16 μm diam, the walls hyaline, thin. Basidia (Fig. 3) cylindrical with a slightly enlarged apex to slenderly clavate, 27-35 (-40) x 5-6 (-7) μm, with four sterigmata, each 5 μm long. Basidiospores (Fig. 2) cylindrical-ellipsoid to broadly ellipsoid, adaxially often slightly concave, some with the basal one-third bent towards the adaxial surface, 6.0-7.5 (-9.0) x 3.0-3.5 (-4.0) μm, the walls hyaline thin, smooth, nonamyloid, acyanophilous, with a minute apiculus.

Habitat: On bark and wood of fallen dead twigs and small branches, to 20 mm diameter, of a variety of woody angiosperms, especially *Quercus* sp., associated with a white rot. Often on charred or partially charred wood.

Distribution: In North America known only from eastern and central United States. The specimens examined ranged from Iowa to the Atlantic coast, and from Michigan and Connecticut south to Mississippi and Alabama.

Notes: Hymenial color, basidiome size and reflexed habit of some specimens is very similar to that of *Meruliopsis corium* (Pers.:Fr.) Ginns. The species of *Meruliopsis* differ from *P. pallida* in having simple-septate hyphae.

The fungus appears to be allied to species in *Chondrostereum* Pouzar, *Mycoacia* Donk, *Phlebia* Fr., and *Pirex* Hjort. & Ryv. However, *Phlebia* appears to be the most satisfactory place for this species. *Phlebia* is a rather large genus of "rather vague circumscription" (Eriksson *et al.* 1981). The type species, *P. radiata* Fr., has a hymenial surface which can be smooth, tuberculate, or folded. A somewhat greater variation in hymenial configuration is encountered when all species of *Phlebia* are considered. The slenderly clavate basidia, the thickening hymenium, and the basidiospore sizes and shapes of *P. pallida* are typical of several species of *Phlebia*. *Pirex* is monospecific and characterized by a bright yellow hymenium, when fresh, and a brown subiculum. *Chondrostereum* is monospecific and is characterized by a multilayered pileus context, smooth hymenial surface and numerous vesicles. *Mycoacia* species typically turn red when in KOH.

As reports of this fungus increased its known geographic range expanded. However, some statements describing its range have been over enthusiastic. Lloyd (1917) considered it to be rather rare. Miller (1934) stated that the species was "widely reported from the central and eastern states." Then Miller and Boyle (1943), in a revision of Miller's (1934) studies, commented that this species is "widely reported from the United States," and Gilbertson (1965) stated that the species is "reported as widely distributed in North America ... and Europe (Nikolajeva, 1961)." However, there are no data to support the significant increase in the geographic range from "central and eastern states" to "widely distributed in North America ... and Europe ...." The fungus has not been reported in Europe; Nikolajeva (1961) cited one collection from the Soviet Far East (Sakhalin Region).

Lloyd (1924: 1276) reported a specimen (Lloyd Herb. 19110) from Maine, but I have redetermined it to be *Meruliopsis corium*. Magasi and Manley (1975) reported *R. pallidum* on *Abies* and *Prunus* in Prince Edward Island, Canada. These records were based upon field observations (no specimens exist) and, I suspect, were misidentifications.

No confirmed reports or collections have been seen which were dated after 1943, but this may not reflect the true status of the fungus in nature.

Specimens examined: **United States**. **Alabama**: Montgomery, no date, on thin bark of ?limb of *Quercus*, associated with a white rot, R.P. Burke 97, MBG 22427, det. E.A. Burt (BPI 263454). **Connecticut**: East Granby, 2 Dec. 1934, on bark and decorticated wood of branches of *Platanus occidentalis* on the ground, H.G. Eno, FP 81229, det. R.F. Cain (BPI 263457). **Illinois**: St. Clair Co.: Vulcan, 31 Jan. 1941, on charred hardwood, G.D. Darker 6839, MBG 159177 (BPI 263450, DAOM 73009). **Iowa**: Iowa City, 19 Aug. 1936, on bark of ?*Prunus*, G.W. Martin (BPI 263451). **Kentucky**: Crittenden, 2 June 1907, on decorticated wood of *Quercus* sp., C.G. Lloyd, Lloyd Herb. 26508 (BPI 325690). **Maryland**: Takoma Park, N of Washington, 1 March 1903, on ?*Quercus*, C.L. Shear, det. L.W. Miller (BPI 263460). **Michigan**: Whitmore Lake, 17 Oct. 1914, on bark of hardwood, A.H.W. Povah 9, MBG 16829 (BPI 263449). **Mississippi**: Biloxi, O.M. Oleson, no date, Lloyd Herb. 26503 (BPI 325691). **New Jersey**: Newfield, 24 June 1896, on bark of decaying

Quercus, J.B. Ellis, det. Bresadola (BPI 263459). **New York**: Long Island: Jamaica, 2 Nov. 1909, on slightly charred *Quercus*, F.H. Ames (BPI 263453). **Ohio**: Cincinnati, no date, C.G. Lloyd 4296 (BPI 263456) and Toledo, 5 Nov. 1920, on charred hardwood twigs and branches, W.R. Lowater, Lloyd Herb. 51124 (BPI 325526). **South Carolina**: Society Hill, March 1849, on bark of 10 mm diam branches of *Carya* sp., M.A. Curtis 2599 (FH **isotype**).

ACKNOWLEDGMENTS

Drs. Amy Rossman and David Farr, and the staff of the National Fungus Collections (BPI) provided valuable assistance that made my visit in April 1992 profitable and enjoyable. Dr. D.H. Pfister (FH) kindly loaned specimens from the Curtis Collection. Ms. Louise Lefebvre completed the layout and inking of the drawings.

LITERATURE CITED

Anonymous. 1929-1942. *Munsell book of color.* Munsell Color Co., Baltimore.

Boidin, J. 1958. Essai biotaxonomique sur les Hydnés Résupinés et les Corticiés. Rev. Mycol. (Paris). Mém. hors-sér. **6**: 1-387.

Donk, M.A. 1956. The generic names proposed for Hymenomycetes-V. "Hydnaceae". Taxon **5**: 95-115.

Eriksson, J., K. Hjortstam & L. Ryvarden. 1981. *Phlebia - Sarcodontia.* Corticiaceae of North Europe **6**: 1051-1276.

Gilbertson, R.L. 1965. Resupinate hydnaceous fungi of North America V. Type studies of species described by Berkeley and Curtis. Mycologia **57**: 845-871.

Hawksworth, D.L., B.C. Sutton & G.C. Ainsworth. 1983. *Dictionary of the fungi.* 7th Ed. Commonwealth Mycological Institute, Kew. 445 p.

Hjortstam, K., K.-H. Larsson & L. Ryvarden. 1987. Introduction and keys. Corticiaceae of North Europe **1**: 1-59.

Holmgren, P.K., N.H. Holmgren and L.C. Barnett. 1990. Index Herbariorum, Part I. 8th Ed. Regnum Vegetabile **120**: 1-693.

Lloyd, C.G. 1917. The genus *Radulum.* Mycological Writings **5**: bis 876. 12 p.

____. 1924. Mycological Notes No. 72. Mycological Writings **7**: 1269-1300.

Magasi, L.P. and J.M. Manley. 1975. *Forest fungi of the Maritime Provinces of Canada. Part 1: Fungus Index.* Canadian Forestry Service, Fredericton, Information Report M-X-51. 161 p.

Miller, L.W. 1934. The Hydnaceae of Iowa III. Mycologia **26**: 212-219.

____ *and J.S. Boyle.* 1943. The Hydnaceae of Iowa. Univ. Iowa Studies Nat. Hist. **18** (2): 1-92.

Nikolajeva, T. 1961. Hydnaceous Fungi. In: V. Savic (Ed.), Flora Spor. Rast. SSSR **6** (2): 1-432. English translation 1977.

MYCOTAXON

Volume XLVI, pp. 329-333 January-March 1993

IDENTITY AND TAXONOMY OF HITHERTO UNREPORTED PATHOGEN CAUSING LEAF SPOT DISEASE OF GINGER IN INDIA

M.K. RAI

Department of Botany, Danielson College, Chhindwara - 480-001, (M.P.) India

ABSTRACT

Leaf-spot disease of Ginger(Zingiber officinale Rosc.) is described and illustrated. The causal pathogen was identified as Phoma exigua var. exigua Deem.

INTRODUCTION

Various leaf-spot diseases have been reported on Ginger in the recent past (Sundarraman, 1922; Mc Rae, 1924; Nishikado, 1927; Ramakrishan, 1942; Sundaram, 1954; Simmonds, 1955; Ramakrishnan, 1956; Sohi et al., 1964; Anonymous 1971,72,74; Turner; 1971; Iyer, 1987). However, the present leaf-spot disease is being reported for the first time from India (Bilgrami et al. 1979 and Sarbhoy et al., 1986).

The principal aim of the present investigation was to report and study the identity and taxonomy of causal organism in vitro on different culture media.

MATERIALS AND METHODS

Infected leaves of Ginger were dried in plant press. Pin-head-like pycnidia were directly observed on the infected part with the help of low power of the compound microscope. Thin hand sections were also cut through pycnidia to study the morphology. For cultural and morphological studies, Potato-dextrose-agar (filtered extract of 250 g of peeled potatoes, 15 g glucose, 20 g agar-agar and water 1 litre) and Malt-agar (malt-extract 15 g, agar 17 g, and water 1 liter) were selected. Cultures were incubated at 28 $\pm$ 2^{0}C for a week.

Conidia produced from mature pycnidia were selected for measurement. They were mounted in lacto-phenol-cotton-blue. Aqueous mounts were prepared for the identification, especially

to observe guttules, and shape of conidia. The conidiogenesis was observed in young pycnidia. A small disc of 1 cm diameter was inoculated at the centre of agar plate. The discs were cut from the margin of 1-3 week old sporulating culture. The diameter of the colonies was measured and calculated after a week.

RESULTS AND DISCUSSION

Observation on the host

Symptoms : Initially the spots were globose to sub-globose, brownish or ashy-grey, in some leaves ashy-grey streaks in the upper surface of leaves, enlarge to form bigger lesions. Later, infected portion of the leaf became dry and numerous black, pin-head-like pycnidia developed

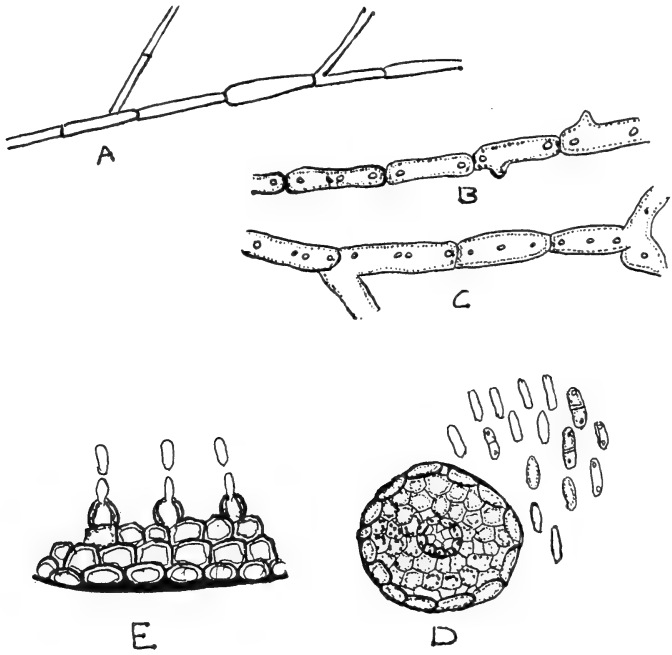


Fig. 1.A. hyaline, septate, branched mycelium
B. mycelium constricted at hypha
C. Details of hypha showing guttules
D. Pycnidia and conidia
E. conidiogenous cells and conidia

Morphology of the pathogen on the host

Mycelium hyaline, septate, profusely branched; pycnidia sub-globose to globose, embedded in necrotic tissues, light-brown to pale-yellow, pseudoparenchymatous, ostiolate, ostioles surrounded by a ring of dark-brown cells, 60-295 µm; conidia exuded through the ostiole in a cream coloured mass, hyaline, 1-2 celled, smooth-walled, ovoid to ellipsoid, mostly ellipsoid with obtuse ends, guttulated, 3.5- 10 x 2-3.7 µm; conidiogenous cells phialidic, hyaline, simple, smooth-walled, sub-globose to broadly flask-shaped.(Fig.1).

Observations on agar media

Cultural characteristics: Colonies varied from greyish-black to reddish-brown colour with concentric rings (clear from reverse), irregularly scalloped margins, 5.2-5.5 cm in dia. in 7 days mycelia hyaline, mostly aerial, septate, profusely branched; pycnidia mostly in concentric rings (clear from reverse) abundant, sometimes in clusters, greyish-black, globose to sub-globose, mostly flask-shaped, few coalesce to form compound fructifications of various shape, parenchymatous, 50-260 µm; conidia hyaline, 1-celled (few 2-celled), some ellipsoid with obtuse ends; few ovoid, 4-11.2 x 1.9-3.7 µm; conidiogenous cells phialidic, hyaline, simple, smooth, ampulliform and enteroblastic; chlamydospores-like (pseudoparenchymatous), mostly hyaline, constricted at septa, aggregated and interweaving, especially in the vicinity of pycnidial groups to form loose, stroma-like bodies subtending the conidiomata. Much pigmentation was observed in malt-agar in comparison to Potato-dextrose-agar. Profuse pigmentation was observed in malt-agar in comparison to Potato-dextrose-agar. Profuse pigmentation was observed in day light.

Usually confusion arises between P. exigua and P. herbarum. However, in the former the growth of the colony is faster in comparison to later (Rai, 1981). In P. exigua irregularly scalloped margin and bigger conidia are formed while in P. herbarum such margin is not reported. Moreover, conidia are relatively smaller. In P. exigua brown to red coloured pigments produced on MA changes to greenish-blue which turns to reddish, lateron, whereas, in P. herbarum red pigments produced on MA changed to blue after addition of a drop of NaOH. Sometimes, differentiation is difficult between P. exigua and P. sorghina (Morgan-Jones and Burch, 1988; Rai, 1981)

The oxidation-reduction test exhibits that metabolite E is formed in agar medium. The metabolite oxidizes easily to pigment a initially and pigment β lateron. Characteristic blue-green colour is produced (a) by application of strong solution of NaOH which gradually passess to red (pigment β). The final red solution (β) stains yellow on addition of conc. Hydrochloric acid. So far, the chemical nature of all the three pigments mentioned above has not been traced out.

ACKNOWLEDGEMENTS

I am grateful to Professor R. C. Rajak, Department of Bio-Sciences, Rani Durgawati Vishwa Vidhyalaya, Jabalpur for encouragement; to Professor R.P. Thakre, Department of Botany, Nagpur University, Nagpur for critically going through the manuscript; and to Professor Lawrence M. Lall, Principal, Danielson College, for laboratory facilities.

LITERATURE CITED

ANONYMOUS 1971. Plant Pathology, Report, Department of Agriculture, Mauritius, 1967, p 99-108.

ANONYMOUS. 1972. Annual report of the Research branch, Department of Agriculture, Sarawak for the year, 1971. pp 191.

ANONYMOUS, 1974. Annual report 1973. Central Plantation crops Research Institute, Kasaragod. pp 149-151.

BILGRAMI. K.S., JAMALUDDIN, and M.A. RIZWI. 1974. Fungi of India. Part I. List and References, To-day and Tomorrow's Printers and Publishers, New-DELHI, pp 467.

IYER, Y. 1987. Diseases of Ginger: in Rev. Trop. Pl. Path. 4:251-288, To-day and Tomorrows Printers and publishers, New-Delhi.

Mc RAE, W. 1924. Economic Botany Part III. Mycology 1922-23. Ann. Report. Board of Scientific Advice, India. 1922-23, 31-35.

MORGAN-JONES and K.B. BURCH. 1988. Studies in the genus Phoma. XIII. Concerning Phoma exigua var. exigua, a cosmopolitan, ubiquitous fungus on diseases and dead plant material. Mycotaxon 32: 477-490.

NISHIKADO, Y. 1927. Studies on the rice blast disease. Jap. J.Bot., 3:239-244.

RAI, M.K. 1981. Studies on some Indian Sphaeropsidales with special reference to Phoma and related fungi. Ph. D. Thesis, University of Jabalpur, MP,India.

SARBHOY, A.K., D.K. AGRAWAL AND J.L. VARSHNEY. 1986. Fungi of India (1977-1981) Associated Publ. Co., N-Delhi, pp 268.

SIMMONDS, J.H. 1955. Science Branch, Pathology section- Rep. Dep. Agric. Qd. 1953-54, pp 55-56, 1954, 1954-55, pp 51-52.

SOHI, H.S., S.S. JIAN, S.L. SHARMA, AND B.R. VERMA. 1964. (dept. of Agric. Himachal Pradesh, Solan). New Records on plant diseases from Himachal Pradesh. Indian Phytopath, 17: 35-41.

SUNDARAM, N.V. 1954. Thread blight of Ginger. Indian Phytopath. 6: 80-85.

SUNDARARAMAN, S. 1922. a new ginger disease in Godawari District. Mem. Dep. agric. India (Bot. Ser.) II: 209-217.

TURNER, G.J. 1971. Fungi and plant disease in Sarawak. Phytopathological papers, Kao No 13 : 39.

Contact address:

Dr. M.K. RAI
Department of Botany
Danielson College
Chhindwara-480 001, M.P.
INDIA

MYCOTAXON

Volume XLVI, pp. 335-341 January-March 1993

MYROTHECIUM GROENLANDICUM SP. NOV., A PRESUMED ENDOPHYTIC FUNGUS OF BETULA NANA (GREENLAND).

MICHAEL BOHN

Institut for Sporeplanter, Øster Farimagsgade 2D, DK-1353 Copenhagen K, Denmark.

ABSTRACT

Myrothecium groenlandicum sp.nov. is described, and its relationship to the genus Myrothecium (Tulloch 1972) is briefly discussed.

INTRODUCTION

During the study of endophytic fungi of plants collected in southern Greenland, an apparently new species of Myrothecium was isolated from twigs of Betula nana L. This species is here described.

MATERIALS AND METHODS

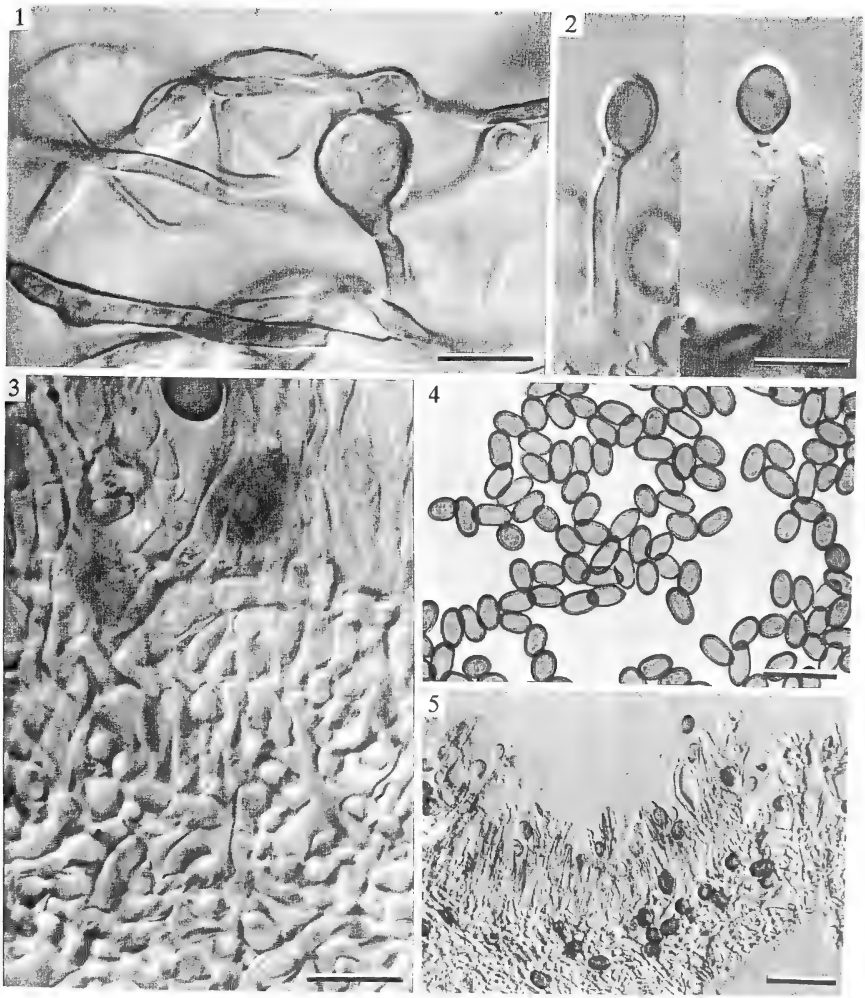
Twigs from 3 apparently healthy plants of Betula nana were collected and transported in plastic bags to Denmark. The twigs (2-7mm wide), which showed no signs of infection, were cut into small pieces (2-4 cm), and sterilized for 1 minute in 96% alcohol, for 5 minutes in 7,5% Na-hypochlorite and finally, 1 minute in 96% alcohol (method as described by O. Petrini, 1986). The twigs were then inoculated on 2% malt extract agar (MA) with 50ppm oxytetracyclin, and inoculated until growth was observed (3-5 days).
The isolated strains were then inoculated on 2% MA and on potato dextrose agar (PDA) and incubated for 7 days in darkness, followed by up to 3 months incubation at 19-22° C, under near-ultraviolet and

cool-white fluorescent light with a cycle of 12 h light/12 h dark. Observations were made after 10 and 20 days. Colours according to Kornerup & Wanscher (1983).

Myrothecium groenlandicum M. Bohn, sp. nov. (Figs 1-6)

A congeneribus conidiis latissimis, atratis et cellulis conidiogenis annulatis diversa. Holotypus: UPSC 3416 cultura siccata, isolata e ramunculo Betulae nanae L., Greenland Qaqortoq (61°lat. bor., 46°long. occ.), VII, 1991, M. Bohn (C).

Colonies on PDA and MA attain a diameter of 30-33 mm in 10 days (52-62 mm after 20 days), appearing leathery, at first whitish to greyish, later becoming greyish orange (6 B-C3), particularly on MA, margin superficial, entire on MA but fimbriate to lobate on PDA; exudate and diffusible pigment absent; reverse greyish orange, especially at margin. Advancing hyphae hyaline, flexuous, smooth, thin-walled, 1.5-4 µm wide; aerial hyphae lanose, greyish in mass, yellowish under microscope, ca. 2 µm wide, wall thick, verruculose to encrusted, showing brownish, thick-walled, chlamydospore-like swollen portions, up to 6-18 µm diam. Conidiomata appear after ca. 14 days as dark green pustules of various size, irregularly scattered over the colony surface, but sometimes arranged in concentric rings, particularly in old cultures, initially covered by mycelium but becoming almost black and shiny at later stages due to the mass of conidia; conidioma sporodochial, irregular, dark green, up to 2 mm diam, scattered, gregarious or coalesced, composed of a 50-70 µm high stroma of textura intricata and conidiophores. Marginal hyphae and setae absent. Conidiophores arising from the stroma, branched, septate, yellowish to brownish, ca. 40-75 µm x 2-4 µm. Conidiogenous cells cylindrical to subulate, 15-25 µm x 2-3 µm, arranged in verticils of 2-4 at the top of the conidiophore, sometimes also intercalary, provided with conspicuous, pigmented collarettes, and producing conidia by percurrent growth. Conidia black and shiny in mass, olivaceous to brownish under



Figs 1-5. Myrothecium groenlandicum. **Fig. 1.** Aerial hyphae with swollen, chlamydospore-like portions (scale bar = 10 µm). **Fig. 2.** Two conidiogenous cells showing annellides and attached conidia (scale bar = 10 µm). **Fig. 3.** Portion of the conidioma base (scale bar = 10 µm). **Fig. 4.** Conidia (scale bar = 20 µm). **Fig. 5.** Vertical section of a conidioma (scale bar = 40 µm), showing conidiophores, conidiogenous cells and conidia (scale bar = 40 µm). Figs 1-5 are from the holotype.

microscope, straight, cylindrical with rounded ends, sometimes slightly narrowing towards base or apiculate, (9-)10x12(-15) µm x (5-)6(-7) µm, with smooth wall. Teleomorph not formed after 3 months incubation.
Holotype: dried reference culture (UPSC 3416) isolated from twigs of Betula nana L., Greenland, Qaqortoq (61°N, 46°W), July 1991, M. Bohn (C). Isotype in UPS. Living cultures: UPSC 3407 and 3416.

DISCUSSION

The genus Myrothecium was monographed by Tulloch (1972) who recognized 13 species. Seven more taxa were later described by various authors.
The production of conidia in M. groenlandicum is enhanced if the aerial mycelium is removed. No marginal setae were observed but this may be a cultivation artifact.
M. groenlandicum differs from other species particularly by its much wider (ca. 6 µm) and darkly pigmented conidia, and by the conidiogenous cells provided with numerous and conspicuous collarettes. The maximum width of conidia in the majority of species is under 3.5 µm. Only in M. cinctum (Corda) Sacc. it may reach 4.5 µm, but in this species the conidia are also provided with dark, longitudinal striae. The size of conidia in M. groenlandicum is most similar to that found in Myrothecium anamorph of Nectria ralfsii Berk. & Br. (Booth, 1959), but in N. ralfsii the conidia are lemon-shaped and the conidiogenous cells are doliform. The conidia in several species of Myrothecium are hyaline, but in most species they are dilute olivaceous. In M. groenlandicum the conidia are pale olivaceous when young but much darker when mature. Tulloch (1972) mentioned the occasionally percurrent condition in Myrothecium cinctum, M. roridum Tode ex Fr. and M. atrum (Desm.) Tulloch, although this feature is not depicted in her monograph. The percurrent conidiogenesis in M. groenlandicum is similar to that observed in M. flavoviride Sutton (1986).
Species of Myrothecium are known for their strong cellulolytic activity (Tulloch 1972; Domsch, Gams

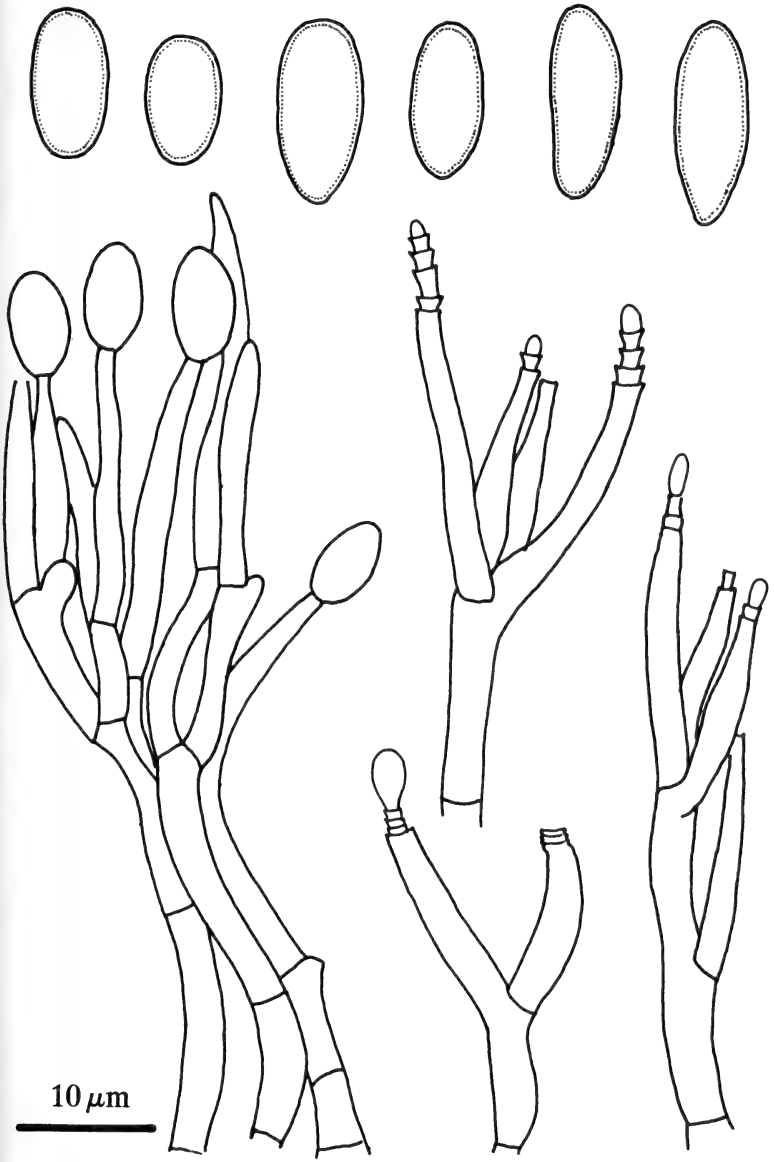


Fig. 6. Myrothecium groenlandicum. Conidiophore, conidiogenous cells and conidia. From the holotype.

& Anderson 1980 and references herein). They are commonly isolated from plants or plant remains, from soil, and only occasionally from such unusual substrates as fruitbodies of larger fungi or algae. No species of Myrothecium has been described as an endophyte.
There exist little information about the teleomorphic stages of Myrothecium, however Myrothecium anamorphs have been connected with Nectria ralfsii Berk. & Br. (Booth, 1959), N. bactridioides Berk. & Br. (Tulloch, 1972) and N. pityrodes Mont. Samuels (1976) suggested that species of Nectria with Myrothecium anamorphs should be classified in another genus. Later, he (Samuels, 1988) described a Myrothecium anamorph in Nectria epichloe Speg., and transferred both N. bactridioides and N. epichloe Speg. to Nectriopsis.

ACKNOWLEDGEMENTS

I wish to thank Dr. O. Constantinescu of the University of Uppsala, Sweden, for his great help with the taxonomy, discussions and comments on the manuscript and technical assistance with the illustrations. I also want to thank Dr. Henry Dissing of the University of Copenhagen, for his valuable suggestions during preparation of this paper. The support of the Jakob E. Lange fund made it possible for me to participate in O. Constantinescu's course of mycology, March 1992. Tyge Christensen checked the Latin diagnosis.

REFERENCES

Booth, C. 1959. Studies of Pyrenomycetes: IV. Nectria (Part I). - Mycological Papers 73, 1-115.
Domsch, K. H., Gams, W. & Anderson, T.-H. 1980. Compendium of Soil Fungi. - London: Academic Press.
Kornerup, A. & Wanscher, J. H. 1983. Methuen Handbook of Colour. - Norwich: Fletcher & Son.
Petrini,O. 1986. Taxonomi of endophytic fungi of aerial plant tissues (p.175-187). Fokkema, N.J. & J. van den Heuvel(eds.): Microbiology of the Phyllosphere. - Cambridge University Press.
Samuels, G. J. 1976. A revision of the fungi formerly classified as Nectria subgenus

Hyphonectria. - Memoirs of the New York Botanical Garden 26, 1-126.
Samuels, G. J. 1988. Fungicolous, lichenicolous, and myxomyceticolous species of Hypocreopsis, Nectriopsis, Nectria, Peristomialis, and Trichonectria. - Memoirs of the New York Botanical Garden 48, 11-78.
Sutton, B. C. 1986. Notes on Deuteromycetes. - Sydowia 38, 324-338.
Tulloch, M. 1972. The genus Myrothecium Tode ex Fr. - Mycological Papers 130, 1-42.

MYCOTAXON

Volume XLVI, pp. 343-358 January-March 1993

PHAEOCOLLYBIA IN WESTERN CANADA

SCOTT A. REDHEAD

Centre for Land and Biological Resources Research
Research Branch, Agriculture Canada
Ottawa, Ontario, Canada, K1A 0C6

and

LORELEI L. NORVELL

Department of Botany, KB-15
University of Washington
Seattle, WA 98195, U.S.A.

ABSTRACT - The first records of *Phaeocollybia* from western Canada are documented along with additional eastern Canadian collections. Both *P. carmanahensis sp. nov.* and a form of *P. kauffmanii*, new to Canada, were discovered in old growth forest in the Carmanah Valley, Vancouver Island, B.C. Taxonomic problems in the *P. kauffmanii* complex in both the eastern and western United States are discussed. The presence of minute capitate cystidioid elements on the pseudorhizae is reconfirmed as a generic feature.

KEY WORDS: *Phaeocollybia*, Agaricales, Cortinariaceae, conservation, virgin forest, new species, Pacific Northwest, Scanning Electron Microscopy.

INTRODUCTION

Species in the genus *Phaeocollybia* Heim (1931) have been recorded as rare to uncommon in eastern Canada, several New England states, the Great Lakes region and the southern Appalachians in the U.S.A. (Bigelow & Barr 1963, 1966; Farlow & Burt 1929; Farr & Farr 1976; Hesler 1949; Murrill 1917; Pomerleau & Cooke 1964; Pomerleau 1980; Redhead & Malloch 1986; Smith

1953, 1957b). There is an increased diversity of species in the Mexican highlands (Singer 1957; Guzmán et al. 1987, Bandala-Muñoz et al. 1989) and parts of Central America (Singer 1970, 1987) on the North American continent. Worldwide, however, the genus reaches its greatest diversity within one climatic zone in the coastal forests of the Pacific Northwest (northern California, Oregon, Washington) of the U.S.A. (Smith 1937, 1957a, 1957b; Smith & Trappe 1972). Sixteen species have been reported from these three states.

Although logically the genus was expected to extend northward into British Columbia, despite several searches in different years, no representatives were reported until recently (Norvell & Redhead 1992). In 1991 a renewed search for specimens in B.C. was motivated by the collection of *Phaeocollybia* the previous week on the adjacent Olympic Peninsula of Washington. Three collections representing two species were gathered in stands of old-growth Sitka Spruce, Western Hemlock, and Pacific Silver Fir in the upper Carmanah Valley of Vancouver Island (Norvell 1992).

One species apparently has never been collected before and is here named *P. carmanahensis* to commemorate the old growth site. This species was not represented among the identified or unidentified collections in major North American mycological herbaria. The second Carmanah Valley species represents an atypical but common form of *P. kauffmanii* which has been collected in California, Oregon and Washington by other mycologists. Examination of exsiccati deposited at Ann Arbor (MICH) cited by Smith (1957b) under the latter name has revealed several variations of *P. kauffmanii*, including collections with or without clamp connections, with polymorphic cheilocystidia, and with subtle variations in basidiospore size and shape. These variations, and the taxonomy of the genus in North America, are now the subject of a detailed investigation by Norvell.

During the course of our study, type specimens for most North American taxa were re-examined by Redhead at Ann Arbor (MICH). This was necessitated by discrepancies between the two North American monographs (Smith 1957b, Smith & Trappe 1972) and a synopsis by Horak (1977) in which several North American species were placed in synonymy with European or other North American species.

Fig. 1. *Phaeocollybia carmanahensis* fresh holotype approx. 0.5 X mag.

METHODS

Colour notations in Italics are from Ridgway (1912). Collection numbers by Norvell (LLN) combine year, month, day, and daily specimen number. Basidiospore measurements, shapes and microscopically observed colours, unless otherwise stated, are based upon rehydrated specimens mounted in Melzer's Reagent. Basidiospore lengths include the "beak" or apex, but exclude the apiculus. Spore ornamentation is described as viewed in Melzer's reagent, but was often confirmed by observations in 3% KOH sol. which accentuates the contrast. Scanning electron microscopy (SEM) observations and photographs by Norvell were made on dried specimens rehydrated in moist chambers, fixed in OsO_4,

dehydrated in ETOH baths (30%, 50%, 70%, 95%, 100%, 100%), critically point dried in Freon TF, and sputter coated with Au/Pd in a Hummer V Sputter Coater.

NOTES ON WESTERN CANADIAN SPECIES

PHAEOCOLLYBIA CARMANAHENSIS *Redhead & Norvell sp. nov.*
Figs. 1-5.

Pileus 20-50 mm lat., umbonatus, glabratus, lubricus vel viscidus, plumbeus, maculatus; macula atro-brunnea. Lamellae cinnamomeae, maculatae, adnatae vel subliberae, ventricosae. Stipes 20-25 x 6-12 mm, cartilagineae, hinnuleae, lubricae, radicales; pseudorhizoma usque ad 40 mm longus. Basidiosporae 5.4-7.2 x 3.6-4.3 µm, ovoideae vel subphaseoliformes, brunneae, punctatae. Basidia 29-32 x 6.1-6.3 µm, tetraspora, clavata. Cheilocystidia 24-36 x 5-5.6 µm, clavata. Hyphae fibulis nullis. Pileus pellicula subgelatinosa absitus.

Specimen typicus (LLN 91.10.24-3): DAOM 215607, holotypus; isotypus WTU

PILEUS 20-50 mm wide, nearly plane with subacute prominent umbo and relatively straight margin, lubricous to viscid when fresh, glabrous, colour *Light Drab* overall with *Light Cinnamon Drab* umbo, opaque, darkening to *Dark Vinaceous Brown* around damaged areas. Context centrally 3-5 mm thick, *Drab* coloured with central region tending toward *Pale Cinnamon*; odour farinaceous when crushed; taste farinaceous to bitterish. **LAMELLAE** nearly free, adnexed to narrowly adnate, subcrowded, ventricose, 3.5-5 mm broad at the center, *Cinnamon* with hints of *Drab* and scattered dark stains; lamellulae 3-tiered. **STIPE** central, 20-25 mm extending above ground, 60-85 mm including the pseudorhiza, 6-12 mm wide apically, colour *Fawn* but darkening where handled, smooth, lubricous, cartilaginous, more or less equal above ground; pseudorhiza tapered downwards below ground. **CONTEXT** stuffed, concolorous with exterior, staining reddish when cut, darkened in old damaged areas.

BASIDIOSPORES (Fig. 4) 5.4-7.2 x 3.6-4.3 µm, in profile distinctly inequilateral, adaxially nearly plane, abaxial convex, with a somewhat rounded cone-shaped apex, in face view elliptical to slightly obovate with a tapered bluntly rounded apex giving the spore a "bullet" shape; wall relatively thin compared to most *Phaeocollybia* species but still pronounced, golden brown; surface virtually smooth to

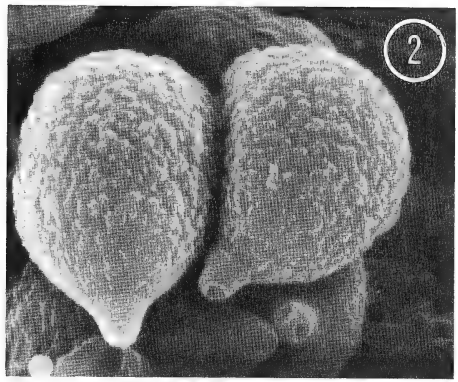
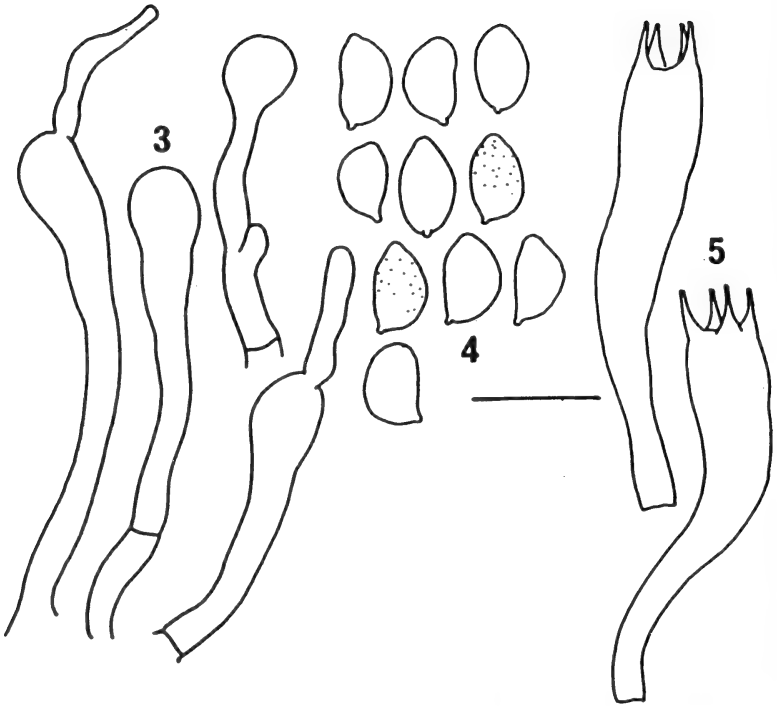


Fig. 2. *Phaeocollybia carmanahensis* isotype basidiospores at 8000 X mag. (SEM)

---

punctate, the ornamentation not visibly projecting in profile (in SEM shown to cover the spores over all; Fig. 2); lacking a germ pore; with a small conspicuous apiculus. **Basidia** (Fig. 5) 4-spored, 29-32 x 6.1-6.3 μm, narrowly clavate, hyaline to slightly brownish at the base. **Cheilocystidia** (Fig. 3) generally narrowly clavate, appearing agglutinated in many mounts and therefore difficult to discern, 24-36 μm long with apical portion 5-5.6 μm diam, the pedicel 2-3 μm diam, with or without additional filamentous apical growths up to 16 μm long (perhaps germination and regrowth of the cystidia); walls smooth, thin, hyaline. **Pleurocystidia** lacking. **Clamp connections** absent throughout basidiomes.

Pileipellis 20-35 μm thick, composed of repent hyaline hyphae 2.7-4.5 μm diam, with subgelatinized to gelatinized outer walls but refractive inner walls, not forming an ixocutis in younger pilei, more conspicuously embedded in a gel in older pilei but with easily discernible walls and conspicuously thickened and refractive septa, the entire layer relatively compact and glassy, overlaying a scarcely differentiated subpellis of similarly sized, non-gelatinized hyphae with dusky contents. **Pileus trama** hyphae compactly arranged radially, subhyaline, (4.5-)10-13 μm diam, with slightly thickened walls. **Lamellar trama** distinctly regular, with hyphae, 3.5-9 μm diam, with slightly thickened hyaline walls in the central region, slightly sordid towards the thin, compact subhymenium.



Figs. 3-5. *Phaeocollybia carmanahensis* holotype (scale = 10 μm). Fig. 3. Cheilocystidia. Fig. 4. Basidiospores. Fig. 5. Basidia.

STIPITIPELLIS on the aerial portion a thin layer of loose, filamentous, hyaline hyphae, 1-3.5 μm diam, possibly in a thin mucous over a compact layer of hyphae 2.5-3.5 μm, sheathing a compact sordid rind of hyphae up to 5 μm diam. **STIPE TRAMA** hyphae strictly parallel, up to 15 μm diam, hyaline. **PSEUDORHIZAL PELLIS** densely covered with tapered conical to lageniform hyaline cystidia-like growths on the refractive walls, up to 20 μm long, 1.5-1.8 μm diam basally, with necks less than 1 μm, with or without a small capitulum and/or an apical droplet.

HABITAT: subcespitose in moss covered forest loam in mountain river flood zone, under *Vaccinium* in old growth *Tsuga heterophylla* (Raf.) Sarg., *Abies amabilis* (Dougl.) Forbes, and *Alnus rubra* Bong. *Picea sitchensis* (Bong.) Carr. not visible at type site but occurring in valley.

HOLOTYPE: British Columbia: Vancouver Island, upper Carmanah Valley, Oct. 24, 1991, coll. Redhead & Norvell (LLN 91.10.24-3 = DAOM 215607); **Isotype** (WTU).

NOTES: *Phaeocollybia carmanahensis* is distinguished by the small, exceedingly finely ornamented basidiospores (Figs. 2, 4), resembling those of *P. oregonensis*, in combination with scarcely differentiated cystidia, clampless hyphae and basidia, a poorly developed ixocutis, small size of basidiomes, nonincrusting pigments and drab coloration. No single feature delimits the species, although the drab coloration is fairly diagnostic. *Phaeocollybia oregonensis* differs from *P.carmanahensis* in having a much larger size (5-11 cm diam pileus) and significantly thicker ixocutis (over 120 μm thick), the matrix of which readily dissolves into a thin gel in 3% KOH solution, unlike the glassy gel of the latter.

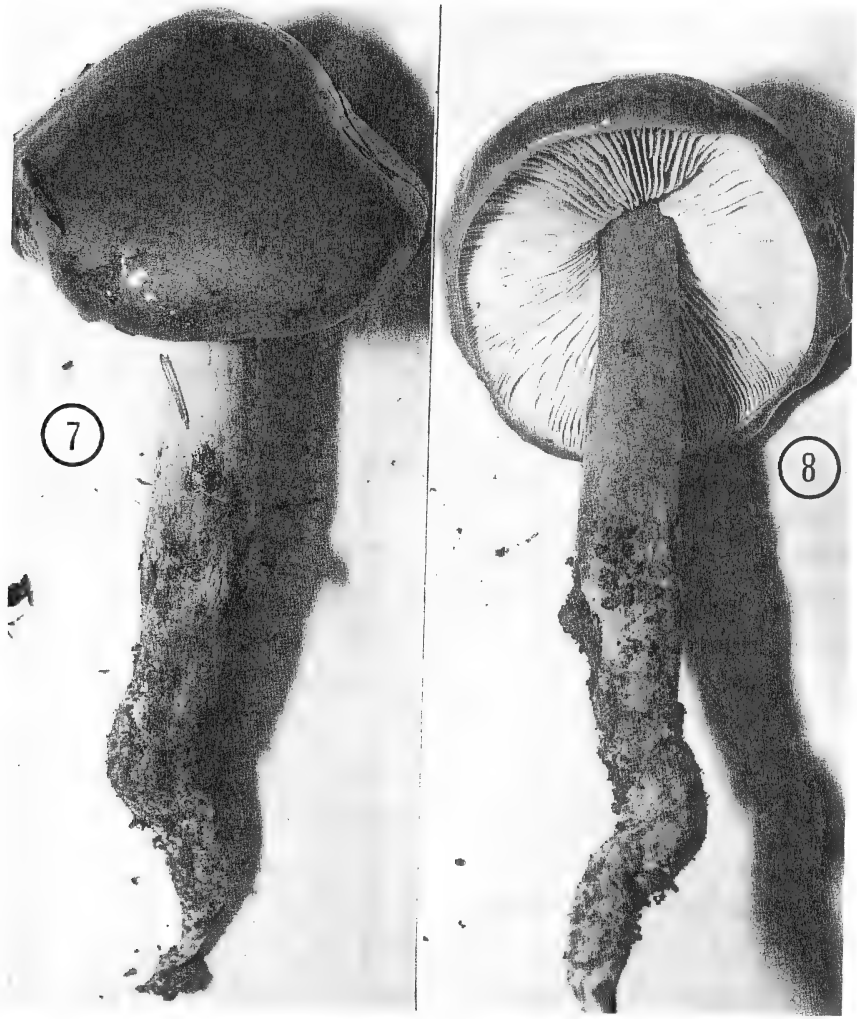
PHAEOCOLLYBIA KAUFFMANII (Smith) Singer, Rev. Mycol. 5: 11. 1940.
≡ *Naucoria kauffmanii* A.H. Smith, Mycologia 29: 52. 1937
Figs. 6-14.

PILEUS 75-104 mm wide, conic convex when young, later developing a pronounced obtuse umbo, inrolled and even outer margin becoming slightly incurved and uneven in age, heavily glutinous when fresh, glabrous, colour generally apricot-brown when young [umbo *Orange Cinnamon* with *Mikado Brown* zones, paler at margin] darkening in age to brown [*Kaiser Brown* to *Cinnamon-Rufous* with darker *Carob Brown* streaks radiating from the margin], opaque. **CONTEXT** centrally 5-8 mm thick, fleshy, concolorous with lamellae but staining orangish 20 minutes after being cut; odour when cut and taste strongly farinaceous, gluten with latently unpleasant taste. **LAMELLAE** narrowly adnate to adnexed becoming nearly free in age, occasionally forked in age, crowded, light *Pale Pinkish Buff* to *Ochraceous Buff*; lamellulae frequent, 3-tiered, irregularly dispersed. **STIPE** central, 60-107 mm extending above ground, 140-235 mm long including pseudorhiza, 15-16 mm wide at apex, swelling slightly to 19-20 mm at ground level before tapering down to the pseudorhiza, colour *Light Pinkish Cinnamon* to *Pinkish Cinnamon* at apex, darkening to *Pale Orange Cinnamon* or *Testaceous* to *Vinaceous Russet* at base, smooth, appressed-fibrillose under hand lens on the aerial portion, moist, cartilaginous. **CONTEXT** stuffed, concolorous with lamellae.

Fig. 6. *Phaeocollybia kauffmanii* (LLN 91.10.24-2) *in situ*, approx. nat. size.

BASIDIOSPORES (Figs. 9, 11, 13) (9.5-)10-11.2(-11.7) x 5.5-6.3 (-6.5) μm, most conspicuously inequilateral in profile, basically an amygdaliform, somewhat elongated shape, the body elongate-elliptical, with a mammiform "beaked" apex and an eccentric prominent apiculus; wall thickened except for the beak and apiculus, prominently ornamented with moderately coarse, obscurely banded rugosity except on the smooth, short, blunt beak and apiculus. **BASIDIA** (Fig. 12) 4-spored, 32-39 x 7.9-9.2 μm, clavate to somewhat cylindrical with a tapered pedicel, hyaline. **CHEILOCYSTIDIA** (Fig. 10) generally clavate, of varying lengths or catenulate, terminal cell 14-

45 μm long, apical portion 5-7.6 μm diam, pedicel 1.8-3.1 μm diam at narrowest portion, smooth, thin-walled, hyaline, crowded, forming a sterile margin. **PLEUROCYSTIDIA** lacking. **CLAMP CONNECTIONS** absent throughout basidiomes.



Figs. 7-8. *Phaeocollybia kauffmanii* (LLN 91.10.24-2) after excavation, approx. nat. size.

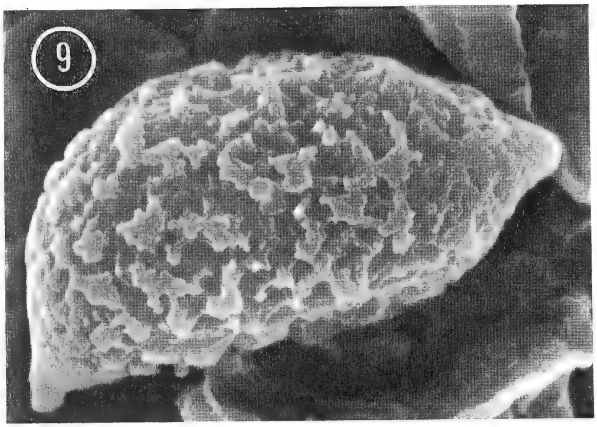
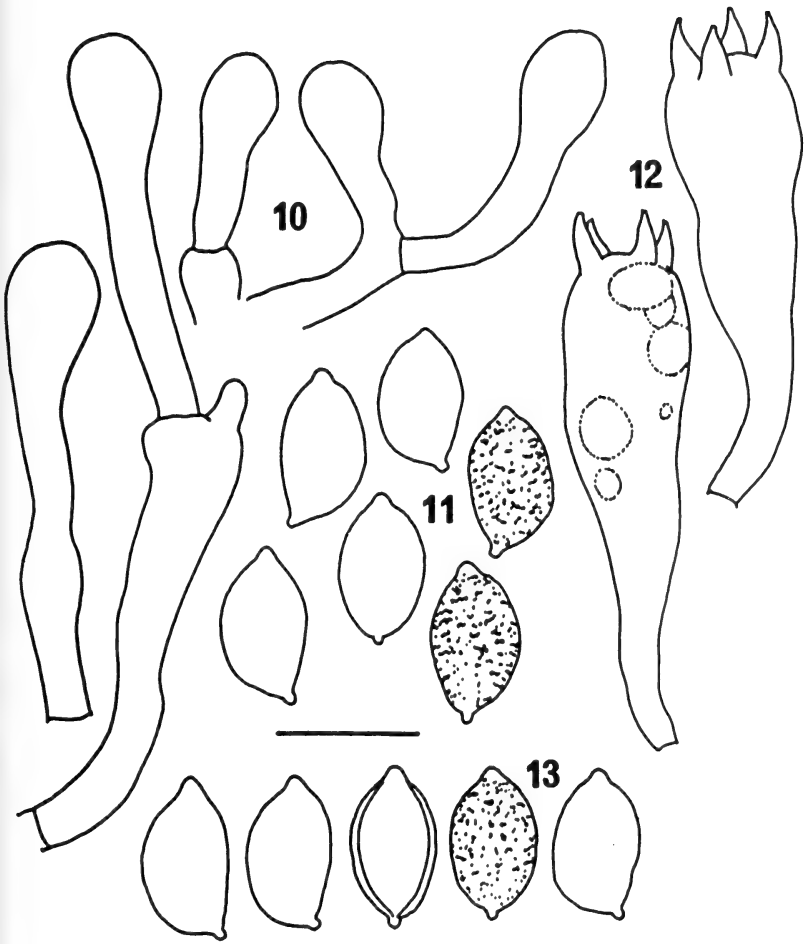


Fig. 9. *Phaeocollybia kauffmanii* (LLN 91.10.24-1) basidiospore at 8000 X mag. (SEM).

PILEIPELLIS a distinct ixotrichodermium often collapsing to an ixocutis, the embedded hyphae 1.5-3.5 μm diam, more or less ascending through the clear gel from the ends of a layer of clavate, catenate cells, 11-15 μm diam immediately above a compact brownish pigmented subpellis of hyphae 4-6 μm diam with walls slightly thickened up to 1 μm. **PILEUS TRAMA** hyphae (5-)15-20 μm diam, loosely radially arranged, with slightly thickened walls. **LAMELLAR TRAMA** regular; hyphae (3-)9-13 μm diam, hyaline except near the brownish subhymenium.

STIPITIPELLIS on the aerial portion a compact layer of parallel hyphae 5-10 μm diam with hyaline to melleous-coloured walls, overlaid with a few scattered loose hyphae 2.5-3 μm diam, possibly in a thin mucilage, the stipitipellis intergrading with trama. **STIPE TRAMA** hyphae up to 24 μm diam, parallel, with slightly thickened walls, hyaline to melleous. **PSEUDORHIZAL PELLIS** hyphae subhyaline to darkly pigmented by moderately coarse encrustations and coagulated brownish contents, outer hyphae densely covered with tapered conical to lageniform hyaline cystidia-like growths (Fig. 14) on the refractive walls, up to 15 μm long, 1-1.5 μm diam basally, with necks less than 1 μm, with or without a small capitulum and/or an apical droplet.



Figs. 10-12. *Phaeocollybia kauffmanii* (LLN 91.10.24-2) scale = 10μm. Fig. 10. Cheilocystidia. Fig. 11. Basidiospores. Fig. 12. Basidia. Fig. 13. (LLN 91.10.24-1) Basidiospores.

HABITAT: scattered in moss covered forest loam in mountain river flood zone, under old growth *Tsuga heterophylla*, *Abies amabilis*, and *Alnus rubra*. *Picea sitchensis* not in immediate vicinity but occurring elsewhere in valley.

SPECIMENS EXAMINED: British Columbia: Vancouver Island, upper Carmanah Valley, Oct. 24, 1991, coll. Redhead & Norvell (LLN 91.10.24-1 = DAOM 215608 & LLN 91.10.24-2 = DAOM 215609; duplicates in WTU).

NOTES: The basidiospore sizes recorded by us for the B.C. collections -- (9.5-)10-11.2(-11.7) x 5.5-6.3(-6.5) μm in Melzer's Reagent -- are distinctly larger than those we measured from the holotype (A.H. Smith 3523; MICH), 8.5-9 X 5.4-5.8 μm, or as previously reported for *P. kauffmanii* by Smith (1937), 8-10 X 4.5-6 (7) μm. These discrepancies, and observations first made by J. F. Ammirati on the presence of clamp connections in some collections caused us to examine collections labelled *P. kauffmanii* previously cited by Smith (1957b) and Smith & Trappe (1972). Smith (1957b) gave a slightly broader basidiospore length range -- 8-10 (11) μm long. We observed a range of basidiospore sizes, subtle variation in the shape of cheilocystidia and collections with either abundant clamp connections, rare clamp connections, and some apparently lacking clamp connections. Any future segregation of taxa at the specific or subspecific levels will require a detailed analysis of these and other features. We have identified other collections from Washington, Oregon and California, which more or less correspond to the B.C. collections in that they lack clamp connections and have slightly more elongated basidiospores than the type specimen does. At this time the differences appear to be too subtle to propose formal taxonomic recognition without additional corroborating evidence.

Aside from the western taxonomic complex treated as *Phaeocollybia kauffmanii*, there have been two published eastern North American records. Both are questionable. Bigelow & Barr (1966) recorded the species from Vermont. Examination of Bigelow's # 13570 (NY ex MASS) confirms that it is immature, the few basidiospores present are not discharged and are possibly under sized and not fully ornamented. Contrary to Bigelow's published description, clamp connections are present and abundant. Specific identification of this material must remain tentative until substantiated by additional collections.

An earlier report by Hesler (1949) from the Great Smoky Mts., Tennessee, was based upon a single mature basidiome which we examined (TENN 17217). It lacks clamp connections unlike the Vermont specimen. Reportedly it lacked the farinaceous odor when fresh, a feature of western *P. kauffmanii*. It also has relatively large coarsely ornamented spores (up to 14 μm in length). The thin, hyaline suprapellis is barely distinct from a uniformly colored (pale brown) subpellis. Hesler (1949) described the pileus as not viscid

when fresh in contrast to the glutinous western *P. kauffmanii* which has a thick ixotrichoderm.

Additional material of both of these eastern taxa, representing the southern Appalachians population and the New England population must be obtained to document their variability. It may be that *P. kauffmanii* does not occur east of the continental divide.

GENERAL OBSERVATIONS ON WESTERN FINDS:

The presence of two species of *Phaeocollybia* on Vancouver Island expands the known range northward into western Canada where the genus had been expected to occur. The Northern Pacific Coast section of the Coast Forest (Rowe 1959) in which the genus occurs extends into the Alaskan panhandle. Given the demonstrated close correlation between macrofungal geography to that of forest types (Redhead 1989), we anticipate the discovery of *Phaeocollybia* in northwestern British Columbia and possibly southwestern Alaska. We also suspect that additional species occur in B.C.

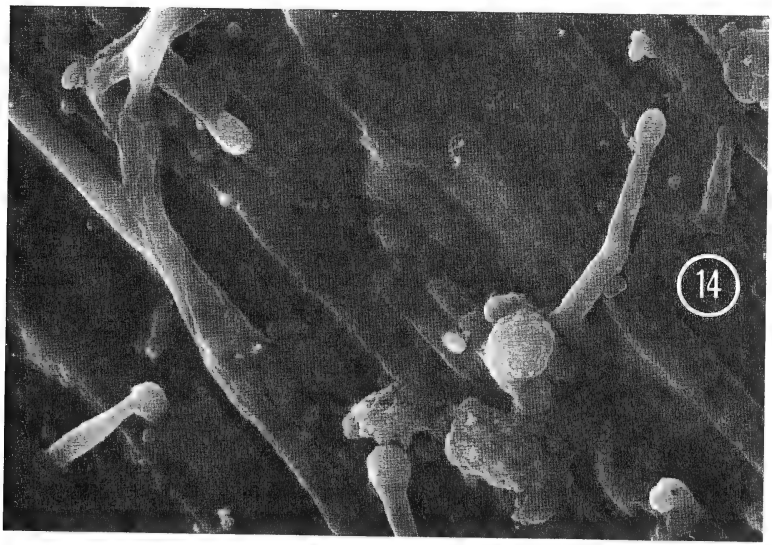


Fig. 14. *Phaeocollybia kauffmanii* (LLN 91.10.24-2) cystidioid elements on pseudorhiza, 3500 X mag. (SEM).

The unexpected discovery of a new species in the ancient forest also draws attention to the need to document North American mycota while such habitats exist. Both *P. carmanahensis* and *P. kauffmanii* and associated fungi may be much more common in western Canada but proof is lacking.

The formation of small capitate cystidioid elements (Fig. 14) on the pseudorhizae was confirmed for both *P. kauffmanii* and *P. carmanahensis* as was predicted for all species in the genus (Redhead & Malloch 1986) and supported by observations by Laber (1991). The specimen of *P. kauffmanii* (DAOM 128319) originally examined for cystidioid elements by Redhead & Malloch has been redetermined to be *P. spadicea* Smith.

ADDITIONAL NOTES ON EASTERN CANADIAN SPECIES

Three species of *Phaeocollybia* were recognized from eastern North America, two of which occur in eastern Canada (Redhead & Malloch 1986). Two additional collections of these two species at MICH have been confirmed:

Phaeocollybia christinae (Fr.) Heim, Encyl. Mycol. 1: 70. 1931.
≡ *Agaricus christinae* Fries, Epicr. Syst. Mycol. p. 192. 1838.
Nova Scotia: Hants Co., Mones Mt., Sept. 19, 1976, B. Shaw 14038.

P. jennyi (Karst.) Romagnesi, Bull. Soc. Mycol. Fr. 58: 127. 1942.
≡ *Naucoria jennyi* Karsten, Hedwigia 20: 178. 1881.
New Brunswick: Sunbury Co., July 31, 1976, K. A. Harrison 13025.

ACKNOWLEDGEMENTS: We thank Drs. R. Shaffer & R. Fogel (MICH) for the use of herbarium facilities and loans, and Drs. R. Halling (NY) and R. Petersen (TENN) for specimen loans. Drs. B. Reim and George Mueller provided invaluable help with the SEM. Special thanks go to Mr. A. MacKinnon, Ms. J. Peterson, Dr. B. Callan & Dr. E. Allen for arranging trips to the Carmanah Valley. Drs. J. Ammirati and Y. Dalpé kindly reviewed the manuscript. Joe Ammirati additionally provided incentive, notes and good natured guidance.

REFERENCES

Bandala-Muñoz, V. M., G. Guzmán, and L. Montoya-Bello. 1989. Additions to the knowledge of *Phaeocollybia* (Agaricales, Cortinariaceae) from Mexico, with description of new species. MYCOTAXON 35: 127-152.

Bigelow, H. E., and M.E. Barr. 1963. Contributions to the fungus flora of northeastern North America. III. RHODORA 65: 289-309.

_____ 1966. Contributions to the fungus flora of northeastern North America. IV. RHODORA 68: 175-191.

Farlow, W.G., and E.A. Burt. 1929. ICONES FARLOWIANAE. ILLUSTRATIONS OF THE LARGER FUNGI OF EASTERN NORTH AMERICA. Farlow Library and Herbarium, Harvard University, Cambridge.

Farr, D. F., and E. R. Farr. 1976. Notes on *Phaeocollybia* and *Pholiota* in the southern Appalachians. *In* THE DISTRIBUTIONAL HISTORY OF THE BIOTA OF THE SOUTHERN APPALACHIANS. PART IV. ALGAE AND FUNGI. *Edited by* C. Parker and M.K. Roane. University Press of Virginia, Charlottesville. pp. 296-306.

Guzmán, G., V. M. Bandala-Muñoz, and L. Montoya-Bello. 1987. The known species of *Phaeocollybia* (Agaricales, Cortinariaceae) in Mexico. MYCOTAXON 30: 221-238.

Heim, R. 1931. Le genre *Inocybe*. Précédé d'une Introduction générale a l'Étude des Agarics Ochrosporés. ENCYL. MYCOL. 1: 1-[431]. Paul Lechevalier & fils, Paris.

Hesler, L. R. 1949. Notes on southern Appalachian fungi. VIII. J. TENN. ACAD. SCI. 24: 81-93.

Horak, E. 1977. Further additions towards a monograph of *Phaeocollybia*. SYDOWIA 29: 28-70.

Laber, D. 1991. Ergänzung zu "Die europäischen Art der Gattung *Phaeocollybia* und ihr Vorkommen im südlichen Schwarzwald." ZEIT. F. MYKOL. 57: 109-116

Murrill, W. A. 1917. *Naucoria*. N. AM. FLORA 10(3): 170-186.

Norvell, L. L. 1992. A Canadian Odyssey. MUSHROOM, THE JOURNAL 10(2): 9-12.

Norvell, L. L., and S. A. Redhead. 1992. *Phaeocollybia* in western Canada with observations on the *P. kauffmanii* complex. Abstract M341. ABSTRACTS OF PRESENTATIONS AT THE 1992 APS/MSA JOINT MEETING. Amer. Phytopath. Soc. & Mycol. Soc. Amer., Portland.

Pomerleau, R. 1980. FLORE DES CHAMPIGNONS AU QUÉBEC ET REGIONS LIMITROPHES. Les éditions la presse, Montreal.

Pomerleau, R., and W. B. Cooke. 1964. IX International Botanical Congress. Field trip No. 22. Quebec fungi. MYCOLOGIA 56: 618-626.

Redhead, S. A. 1989. A biogeographical overview of the Canadian mushroom flora. CAN. J. BOT. 67: 3003-3062.

Redhead, S. A., and D. W. Malloch. 1986. The genus *Phaeocollybia* (Agaricales) in eastern Canada and its biological status. CAN. J. BOT. 64: 1249-1254.

Ridgway, R. 1912. COLOUR STANDARDS AND COLOUR NOMENCLATURE. Washington, D.C.

Rowe, J. S. 1959. FOREST REGIONS OF CANADA. Dept. Northern Affairs and Natl. Resources, Forestry Branch. Bull. 123. 71 pp.

Singer, R. 1957. Fungi mexicani, Series prima - Agaricales. SYDOWIA 11: 354-374.

_____ 1970. *Phaeocollybia* (Cortinariaceae - Basidiomycetes). FLORA NEOTROPICA 4: 1-11.

_____ 1987. *Phaeocollybia* in the oak woods of Costa Rica, with notes on extralimital taxa. MYCOL. HELVETICA 2: 247-266.

Smith, A. H. 1937. New and unusual agarics from the western United States. MYCOLOGIA 29: 45-59.

_____ 1953. New and rare agarics from the Douglas Lake region and Tahquamenon Falls State Park, Michigan, and an account of the North American species of *Xeromphalina*. Pap. Mich Acad. Sci. 38: 53-87.

_____ 1957a. Additional new or unusual North American agarics. SYDOWIA BEIH. 1: 46-61.

_____ 1957b. A contribution toward a monograph of *Phaeocollybia*. BRITTONIA 9: 195-217.

Smith, A. H., and J. M. Trappe. 1972. The higher fungi of Oregon's Cascade Head Experimental Forest and vicinity. I. The genus *Phaeocollybia* (Agaricales) and notes and descriptions of other species in the Agaricales. MYCOLOGIA 64: 1138-1153.

MYCOTAXON

Volume XLVI, pp. 359-361 January-March 1993

ALTERNARIA TRIGLOCHINICOLA SP. NOV.

J.L. ALCORN[1] and S.M. FRANCIS[2]

[1]*Plant Protection Division, Department of Primary Industries, Indooroopilly, Queensland 4068, Australia*

[2]*Boedelhofweg 92, 7211 BT Eefde, The Netherlands*

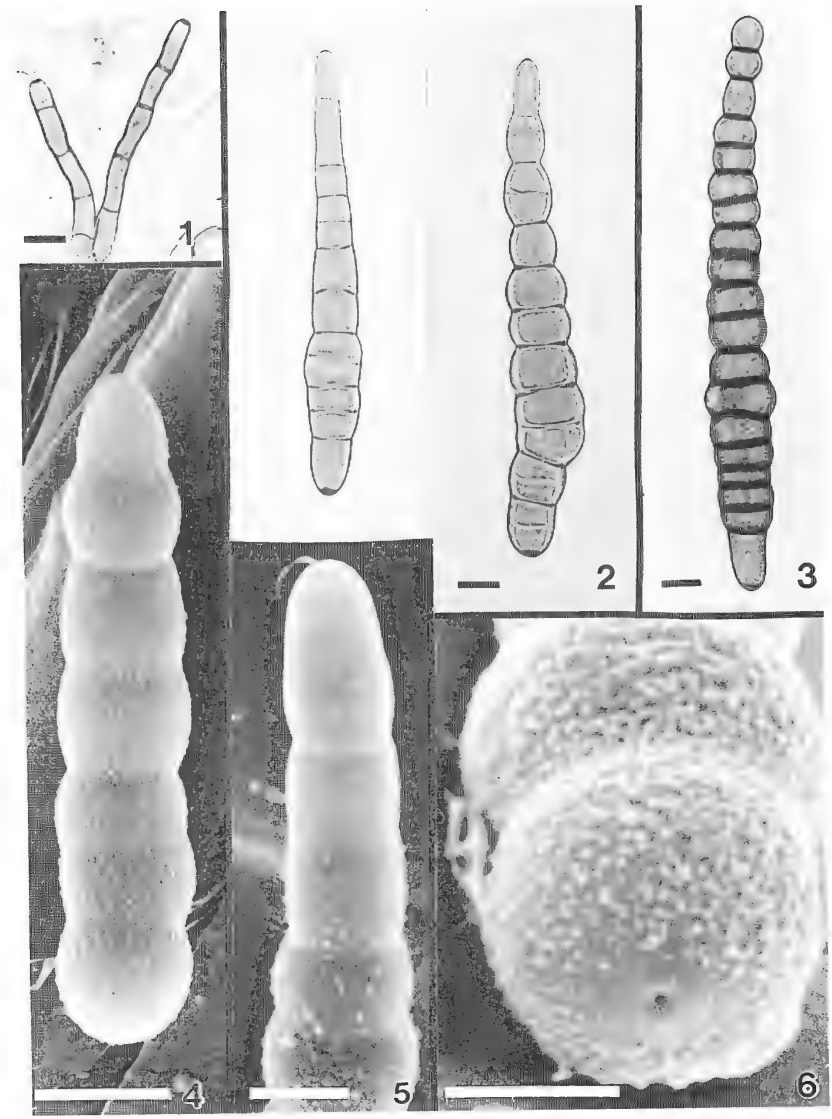
An *Alternaria* collected on *Triglochin procera* R. Br. (Juncaginaceae) in Australia is considered sufficiently distinct from other taxa in the genus to justify its description as a new species.

Alternaria triglochinicola Alcorn & S. Francis, sp.nov. (Figs 1-6)

Conidiophora olivacea brunnea vel pallide brunnea, solitaria vel caespitosa, simplicia vel ramosa, cylindrica, multiseptata, parce geniculata, 25-115 x 5-7.5 µm, interdum ad basim tumida usque ad 11 µm diam. Conidia olivacea brunnea, aurea brunnea vel pallide rufo brunnea, plerumque solitaria, recta, cylindrica vel anguste obclavata, 5-20 septata, ad septa constricta, 0-5 septis verticalibus vel obliquis, laevia vel verruculosa, 48-165 x 11-20 µm.

In foliis vivis *Triglochinis procerae*, Peregian Beach, Queensland, Australia, 24 Oct. 1982, J.L. Alcorn 8242, IMI 273167 holotypus, BRIP 13850 isotypus.

Conidiophores olivaceous brown to mostly pale brown, single or in groups, sometimes emerging from stomata, simple or branched near base, cylindrical, multiseptate, sparingly geniculate, 25-115 x 5-7.5 µm, sometimes swollen at the base to 11 µm diam. Conidia olivaceous brown to mostly golden or pale reddish brown, cylindrical to narrowly obclavate, straight, solitary or occasionally shortly catenate, commonly constricted at most transverse septa, vertical or oblique septa few (0-5), smooth or mostly verruculose, sometimes roughened in the lower part and smooth above, erostrate, 48-165 x 11-20 µm,



Figs 1-6. *Alternaria triglochinicola.* 1. Conidiophores on wheat straw/water agar (BRIP 14071). 2. Conidia from the host (BRIP 13850). 3. Conidium from PDA (BRIP 16813). 4-6. Conidia from wheat straw/water agar (BRIP 13850), showing the entire conidium verruculose **(4)**, the upper part smooth **(5)**, and the smooth hilar area with central pore **(6)**. Scale bars = 10 μm, figs 1-4; 5 μm, figs 5-6.

5-20 septate. Basal cell variable in shape, cylindrical, hemiellipsoidal or hemispheric, with a hilum 3-4 µm diam. Conidia in culture on PDA are similar to those on the host, but ornamentation is slightly more pronounced and constriction at the transverse septa is greater. On water agar + wheat straw conidia are smaller (40-100 x 9-17.5 µm) than on the host or PDA, and have fewer transverse septa (4-14).

The fungus is associated with and can be isolated from large black leaf spots on the host. Pathogenicity has been demonstrated on glasshouse-grown seedlings of *T. procera*, with infection being obtained more readily on leaves wounded prior to inoculation.

Alternaria triglochinicola is most like *A. leucanthemi* Nelen, but differs in producing verruculose conidia whereas those of the latter species are smooth, and in conidial width, 11-20 µm compared with 20-33 µm for *A. leucanthemi* (Simmons, 1965, 1986). In addition conidiophores of *A. leucanthemi* are often 8 µm in diameter (Simmons, 1965) while those of *A. triglochinicola* are commonly 5-6 µm. The taxon is somewhat similar to *A. dennisii* M.B. Ellis but conidia are much larger than in that species, now referred to *Embellisia* (Simmons, 1990). It is quite distinct from the anamorph of *Pleospora triglochinicola* Webster, *Stemphylium triglochinicola* Sutton & Pirozynski.

Other specimens examined. *Triglochin procera*, Peregian Beach, Queensland, Australia, 18 Sept. 1983, J.L. Alcorn 8349, BRIP 14071; 22 Oct. 1989, J.L. Alcorn 8914, BRIP 16813.

We are grateful to E.G. Simmons for his taxonomic advice, to D.H. Gowanlock for the scanning electron micrographs, and to J.A.G. Irwin for reviewing the manuscript.

References

Simmons, E.G. (1965). *Alternaria chrysanthemi*. *Mycologia* **57**, 140-143.

Simmons, E.G. (1986). *Alternaria* themes and variations (17-21). *Mycotaxon* **25**, 203-216.

Simmons, E.G. (1990). *Embellisia* and related teleomorphs. *Mycotaxon* **38**, 251-265.

MYCOTAXON

Volume XLVI, pp. 363-370 January-March 1993

CONIDIUM DEVELOPMENT IN THE KNOXDAVIESIA ANAMORPH OF CERATOCYSTIOPSIS PROTEAE

MARNEL MOUTON, MICHAEL J. WINGFIELD & P. SCHALK VAN WYK
Department of Microbiology and Biochemistry, University of the Orange Free State, P.O. Box 339, Bloemfontein, 9300, South Africa.

Ceratocystiopsis proteae and its anamorph, *Knoxdaviesia proteae*, occur commonly in the infructescences of *Protea repens*. Conidia of *K. proteae* are produced in a gloeoid mass at the apices of phialidic conidiogenous cells. It would thus be expected that the conidia should be produced by apical wall building with enteroblastic proliferation and holoblastic ontogeny. TEM examination of conidium development in *K. proteae*, however, revealed the presence of a delimitation wall layer continuous with the new conidium inner wall. This might indicate some relationship with the ring wall building process. It is our opinion that the wall orientation in this case represents a hitherto unrecognized variation in phialidic conidial development.

INTRODUCTION

The genera *Ophiostoma* H. & P. Sydow, *Ceratocystis sensu stricto* and *Ceratocystiopsis* Upadhyay & Kendrick are included in *Ceratocystis* Ellis & Halst. *sensu lato*. (De Hoog & Scheffer, 1984; Upadhyay, 1981; Wingfield, Van Wyk & Marasas, 1988). *Ophiostoma* is characterized by having anamorphs with apical wall building conidial development (Minter, Kirk and Sutton, 1983a). These include representatives of genera such as *Graphium* Corda, *Sporothrix* Hekt. & Perkins, *Hyalorhinocladiella* Upadhyay & Kendrick and *Leptographium* Lagerberg & Melin (Upadhyay, 1981; Upadhyay & Kendrick, 1975). In contrast, *Ceratocystis sensu stricto* has anamorphs in *Chalara* (Corda) Rabenh. (De Hoog & Scheffer, 1984; Upadhyay, 1981) and possibly *Sporendocladia* Arnaud: Nag Raj & Kendrick, where conidia develop through a ring wall building process (De Hoog and Scheffer, 1984; Minter *et al.*, 1983; Wingfield, Van Wyk & Wingfield, 1987).

Ophiostoma and *Ceratocystis s.s.* can also be distinguished from each other by their cell wall components. *Ophiostoma* spp. have cellulose, chitin and rhamnose in their cell walls. In contrast, *Ceratocystis* spp. have cell walls more typical of Ascomycetes, containing chitin and no cellulose or rhamnose

(Harrington, 1987; Jewell, 1974; Rosinski and Campana, 1964; Smith, Patik & Rosinski, 1967; Weijman and De Hoog, 1974). *Ophiostoma* can also tolerate high concentrations of cycloheximide whereas *Ceratocystis s.s.* is sensitive to this antibiotic (Harrington, 1981).

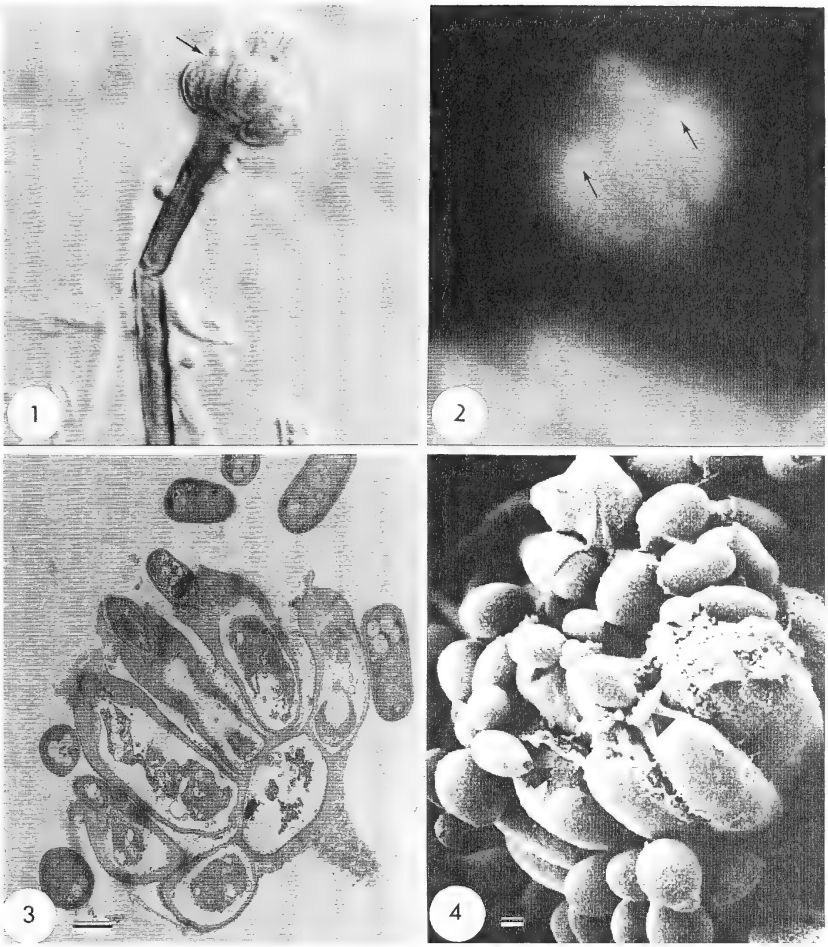
Ceratocystiopsis was established by Upadhyay and Kendrick (1975) to accommodate those species of *Ceratocystis s.l.* with falcate ascospores. Wingfield *et al.* (1988) described a new species of *Ceratocystiopsis*, *C. proteae*, that occurs commonly in the insect-infested infructescences of *Protea repens* (L.) L. *Ceratocystiopsis proteae* was found to share characteristics of *Ceratocystis s.s.* (cycloheximide sensitivity), *Ceratocystiopsis* (falcate ascospores) and *Ophiostoma* (relatively long perithecial necks, divergent ostiolar hyphae and an anamorph with holoblastic conidium development), but because its ascospores were apparently sheathed and falcate, it was thought to be best accommodated in *Ceratocystiopsis*.

Knoxdaviesia Wingfield, Van Wyk & Marasas, a new genus of dematiaceous Hyphomycetes, was established to accommodate the anamorph of *C. proteae*. This genus superficially resembles the Hyphomycete genera *Stachybotrys* Corda and *Phialocephala* Kendrick (Wingfield *et al.*, 1988). *Knoxdaviesia*, like the genera *Phialographium* Upadhyay & Kendrick and *Phialocephala* appears to have distinctly phialidic conidium development. However, only one species of *Ophiostoma*, *O. francke-grosmanniae*, has a *Phialocephala* anamorph (Davidson, 1971; Upadhyay, 1981). Moreover, the latter fungus is thought to be better placed in *Leptographium* (Harrington, 1988). Similarly, studies of conidium ontogeny in species of *Phialographium* suggest that both percurrent and apparent false sympodial proliferation can be observed in single species assigned to the genus (Wingfield, Van Wyk & Van Wyk, 1989). Light microscope studies showed that conidium development in *Knoxdaviesia* is unlike that of the anamorphs of *Ophiostoma* and is possibly more like that of anamorphs of the Hypocreales. In this study, a detailed examination of conidium development in *Knoxdaviesia proteae* was undertaken in the hope that this might improve our understanding of the relationships between this fungus and other anamorphs of *Ceratocystis sensu lato*.

MATERIALS AND METHODS

Knoxdaviesia proteae was isolated from ascomata of *C. proteae* in a *Protea repens* infructescence at Stellenbosch in the Cape Province of South Africa. The culture was grown on 2 % malt extract agar (20 g Difco malt extract; 20 g Difco Bacto agar/ 1 L water) in Petri dishes and incubated at 20 °C for approximately two weeks until onset of sporulation.
Conidial development was examined using scanning electron microscopy (SEM), transmission electron microscopy (TEM), light and fluorescence microscopy. Specimens for SEM and TEM were cut from agar and fixed in 3 % glutaraldehyde and 1 % osmium tetroxide in 0.1 M buffer (pH 7.0), and dehydrated in a graded acetone series. Material for SEM was critical point dried (Cohen, 1970), coated with gold/palladium and viewed with an ISI scanning electron microscope.

Material for TEM was fixed in a similar way, embedded according to Spurr (1969) and the epoxy resin was polymerized at 70 °C for 8 hours. Ultrathin sections (60 nm) were cut with glass knives, mounted on copper grids and stained for 20 minutes in uranyl acetate followed by 10 minutes in lead citrate (Reynolds, 1963). Sections were examined with a Phillips EM300 transmission electron microscope.



Figs 1-4. Conidiophores and conidiogenous cells of *K. proteae.* **Fig. 1.** Light micrograph of the conidiophore of *K. proteae* showing a collarette at the apex of a conidiogenous cell (arrow). **Fig. 2.** Fluorescence micrograph of the conidiogenous cells of *K. proteae*, revealing the presence of periclinal thickening (arrows), on the inside of the apices of the conidiogenous cells. **Fig. 3.** TEM of a section through the conidiogenous cells of *K. proteae*, showing distinct phialidic conidiogenous cells with well developed periclinal thickening (Bar = 1 um). **Fig. 4.** SEM of conidiogenous cells of *K. proteae*. Collarettes at the apices of the conidiogenous cells (arrowhead) and conidia with single attachment points (arrow) are typical of phialidic conidial development (Bar = 1 um).

Conidia and conidiophores to be examined using fluorescence microscopy, were mounted on glass slides in a 0.05 % w/v solution of cellifluor white M 2R optical brightener in 0.1 M phosphate buffer. Samples were examined with a Zeiss Axioskop fluorescence microscope, dark background and ultraviolet light (365 nm) and photographed using Ilford FP4 film.

RESULTS

Light and fluorescence microscopy, as well as TEM and SEM examination of conidium development in *K. proteae*, verified the presence of distinctly phialidic conidiogenous cells (Figs 1-4). Small, yet distinct collarettes were obvious at the apex of the majority of conidiogenous cells (Fig. 4). Conidia had single attachment scar (Fig. 5) and were produced in a gloeoid mass at the apex of the phialidic conidiogenous cells.

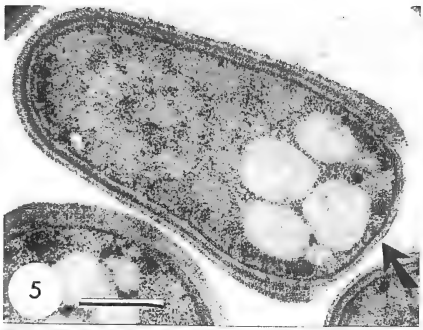
In *K. proteae* the first conidium was produced holoblastically (conidium ontogeny) by apical wall building. At the base of the newly developing conidium, a delimiting septum was formed (Fig. 6). Distinct wall material was observed at the base of newly developed conidia (Fig. 7). It therefore appeared that conidial secession was delayed. A new wall building apex was formed, just below the septum delimiting the preceding conidium. The secretory organelles (apical vesicles), which are responsible for wall synthesis, were also visible below the delimiting septum (Fig. 8). A new wall building apex was therefore simultaneously being produced in the region where the new conidium would develop (Fig. 8). The preceding conidium then seceded (conidial secession) and the second conidium was thus formed by enteroblastic proliferation followed by holoblastic ontogeny.

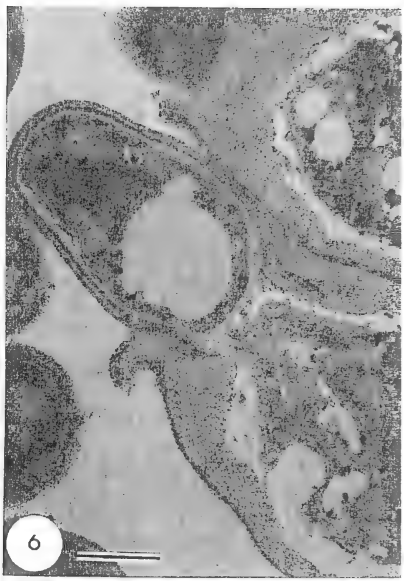
In young conidiogenous cells, very little periclinal thickening was observed (Fig. 9) and, as subsequent conidia were produced, there was an accumulation of proliferation wall layers adjacent to the conidiogenous cells inner walls and, just beneath the collarettes (Figs 6-8). The proliferation wall layer is continuous with the outer wall layer of the new conidium (Figs 7, 8). These wall layers eventually led to the narrowing of the apices of the conidiogenous cells.

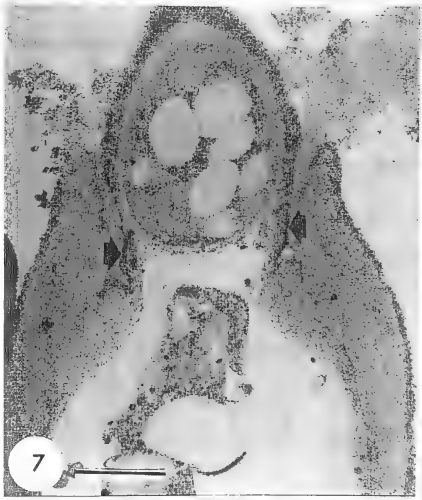
DISCUSSION

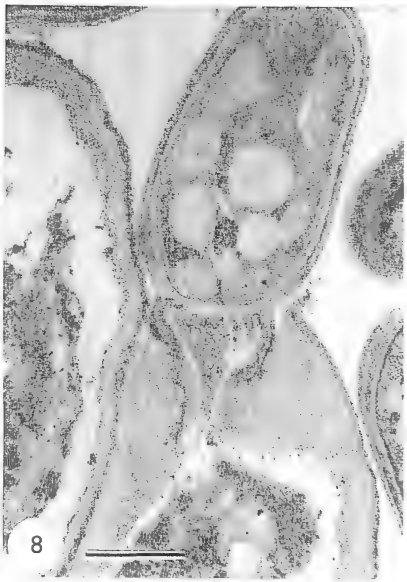
Conidia of *K. proteae* were formed by an apical wall building process. This is also a common feature in the anamorphs of *Ophiostoma* and *Ceratocystiopsis* in contrast to the anamorphs of *Ceratocystis s.s.* where conidia are produced by ring wall building (Minter *et al.*, 1983a).

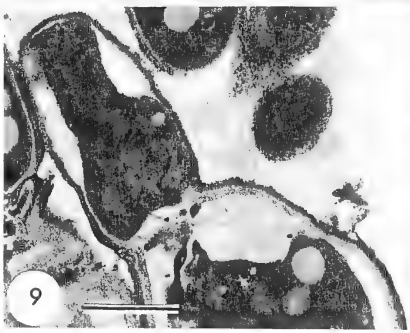
Figs 5-9. TEM of the anamorph of *C. proteae*. **Fig. 5.** A conidium having only one, basal attachment scar (arrow, ⟵) (Bar = 0.5 um). **Fig. 6.** Delimitation of the conidium, preceded by enteroblastic proliferation and holoblastic ontogeny (Bar = 0.5 um). **Fig. 7.** Conidial secession appears to be delayed and new wall layers are formed at the base of the newly developed conidium (arrows) (Bar = 0.5 um). **Fig. 8.** The wall building apex is replaced below the delimiting septum and enteroblastic proliferation occurs in this area (Bar = 0.5 um). **Fig. 9.** A young conidiogenous cell in which very little periclinal thickening is visible, indicating that periclinal thickening results from an accumulation of proliferation wall layers (Bar = 1 um).


5


6


7


8


9

Conidia were oval to cylindrical with a single attachment scar (Fig. 10 A), also indicative of apical wall building. Fungi with ring wall building tend to have cylindrical conidia with two attachment scars (Minter *et al.*, 1982) (Fig. 10 B).

TEM studies revealed the presence of periclinal thickening toward the inside of the walls of the conidiogenous cells just beneath the collarettes. This phenomenon is common in fungi producing conidia from phialides by apical wall building and occurs in species of *Trichoderma* (Cole & Samson, 1979; Hammill, 1974), *Fusarium* (Marchant, 1975; Van Wyk *et al.*, 1987) and *Cryptosporiopsis* (Sutton & Sandhu, 1968). According to Minter *et al.* (1983a) the presence of periclinal thickening indicates a succession of replacement wall building apices and its absence shows the presence of a wall building ring. However, it has also been suggested in *Fusarium* that periclinal thickening has no connection with production of successive conidia (Tiedt, Jooste & Hamilton-Attwell, 1986; Tiedt & Jooste, 1988). We however contest this view and believe that this accumulation of wall layers within the phialide, if it went on long enough, would eventually lead to the blockage of the conidiogenous cell. Our sections through young conidiogenous cells, showing only slight periclinal thickening, support our suspicion. It is surprising however, that a certain degree of periclinal thickening also occurs in the conidiogenous cells of fungi with "true" conidial chains (Minter *et al.*, 1983a). It may be possible that some degree of periclinal thickening is always present and may have a function in protecting the conidiogenous cell or supporting the conidial mass. In this case, we would not expect to see a gradual increase in this thickening, nor would striations indicative of individual walls be present.

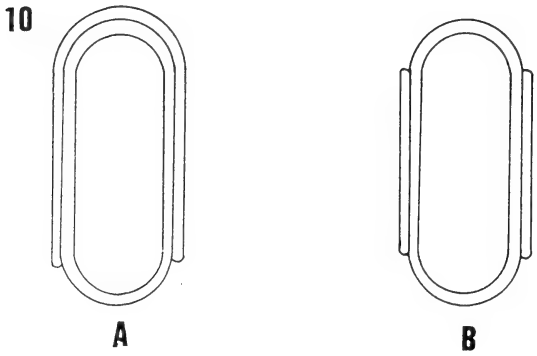


Fig. 10 A, B. Schematic representation of conidia illustrating different arrangements of dehiscence scars. A. Conidium with a singlle, basal dehiscence scar, indicative of apical wall building. B. Conidia produced by ring wall building are characterized by apical and basal dehiscence scars.

From sections through conidiogenous cells, distinct wall material was observed to form during early stages of proliferation, below the delimiting septum, and it therefore appeared that conidial secession was delayed. However, these cell walls apparently represent a form of apical wall building with a centripetal (lateral) onset of the proliferation stage and might indicate some relationship with the ring wall building process. This is in contrast to *Fusarium* spp. in which the very early stages of proliferation is only apical (centrifugal). The consequence of this phenomenon is still uncertain.

Observations in this study confirm the sentiments of Minter, Sutton and Brady (1983b) that the term phialide can only be used relatively and in specific cases needs careful definition. Certain supposedly diagnostic structures, such as collarettes and periclinal thickening can be misleading.

From our study it was clear that conidia in *K. proteae* develop by an apical wall building process and that no percurrent proliferation occurs. This is an uncommon phenomenon amongst anamorphs of *Ophiostoma*, where percurrent proliferation is usually present (Wingfield, 1985; Wingfield *et al.*, 1987). Conidium development in *K. proteae* was therefore more similar to that of anamorphs of the Hypocreales with apical wall building, phialidic conidiogenous cells and periclinal thickening (Minter *et al.*, 1983a). This adds to the very unusual characteristics of *Ceratocystiopsis protea*. Other anamorphs of *Ceratocystis s.l.*, and particularly species of *Ophiostoma*, should be examined to characterize their patterns of conidium development and to evaluate their taxonomic significance in this group of fungi.

ACKNOWLEDGMENTS

We are grateful to Dr. P.W.J. van Wyk for assistance and advice and appreciate financial support of the Foundation for Research Development. We also thank Dr. W.B. Kendrick for constructive review of this manuscript.

LITERATURE CITED

COHEN, A.L. (1970). Critical point drying. In *Principles and Techniques of Electron Microscopy : Biological Applications* (ed. M.A. Hyat.). New York: Von Nostrand Reinhold.

COLE, G.T. & SAMSON, R.A. (1979). *Patterns of Development in Conidial Fungi*. London, San Franscisco, Melbourne: Pitman.

DAVIDSON, R.W. (1971). New species of *Ceratocystis*. *Mycologia* **63**, 5-15.

DE HOOG, G.S. & SCHEFFER, R.J. (1984). *Ceratocystis* versus *Ophiostoma*: a reappraisal. *Mycologia* **76**, 292-299.

HAMMIL, T.C. (1974). Electron microscopy of phialides and conidiogenesis in *Trichoderma saturnisporum*. *American Journal of Botany* **61**, 15-24.

HARRINGTON, T.C. (1981). Cycloheximide sensitivity as a taxonomic character in *Ceratocystis*. *Mycologia* **73**, 1123-1129.

HARRINGTON, T.C. (1987). New combinations in *Ophiostoma* of *Ceratocystis* species with *Leptographium* anamorphs. *Mycotaxon* **28**, 39-43.

HARRINGTON, T.C. (1988). *Leptographium* species, their distribution, hosts and insect vectors. In *Leptographium root diseases on conifers* (ed. T.C. Harrington & F.W. Cobb Jr.). pp. 1-39. The American Phytopathological Society. St Paul. Minnesota: APS Press.

JEWELL, T.R. (1974). A qualitative study of cellulose distribution in *Ceratocystis* and *Europhium*. *Mycologia* **28**, 39-43.

MARCHANT, R. (1975). An ultrastructural study of "phialospore" formation in *Fusarium culmorum* grown in continuous culture. *Canadian Journal of Botany* **53**, 1978-1987.

MINTER, D.W., KIRK, P.M. & SUTTON, B.C. (1982). Holoblastic phialides. *Transactions of the British Mycological Society* **79**, 75-93.

MINTER, D.W., KIRK, P.M. & SUTTON, B.C. (1983a). Thallic phialides. *Transactions of the British Mycological Society* **80**, 39-66.

MINTER, D.W., SUTTON, B.C. & BRADY, B.L. (1983b). What are phialides anyway? *Transactions of the British Mycological Society* **81**, 109-120.

REYNOLDS, E.S. (1963). The use of lead citrate at high pH as an electron-opaque stain in electron microscopy. *Journal of Cell Biology* **17**, 208-212.

ROSINSKI, M.A. & CAMPANA, R.J. (1964). Chemical analysis of the cell wall of *Ceratocystis ulmi*. *Mycologia* **56**, 738-744.

SMITH, M.J., PATIK, S.C.M. & ROSINSKI, M.A. (1967). A comparison of cellulose production in the genus *Ceratocystis*. *Mycologia* **59**, 956-969.

SPURR, A.R. (1969). A low viscosity embedding medium for electron microscopy. *Journal of Ultrastructural Research* **26**, 31-43.

SUTTON, B.C. & SANDHU, D.K. (1968). Electron microscopy of conidium development and secession in *Cryptosporiopsis* sp., *Phoma fumosa*, *Melanconium bicolor*, and *M. apiocarpum*. *Canadian Journal of Botany* **47**, 745-749.

TIEDT, L.R., JOOSTE, W.J. & HAMILTON-ATTWELL, V.L. (1986). Ultrastructural aspects of conidiogenesis of *Fusarium sacchari* F. sp. *subglutinans*. *Transactions of the British Mycological Society* **87**(2), 237-241.

TIEDT, L.R. & JOOSTE, W.J. (1988). Ultrastructure of collarette formation in *Fusarium* sect. *liseola* and some taxonomic implications. *Transactions of the British Mycological Society* **90** (4), 531-536.

UPADHYAY, H.P. (1981). A monograph of *Ceratocystis* and *Ceratocystiopsis*. Athens. USA: The University of Georgia Press.

UPADHYAY, H.P. & KENDRICK, W.B. (1975). Prodromus for a revision of *Ceratocystis* (Microascales, Ascomycetes) and its conidial states. Mycologia **4**, 798-805.

VAN WYK, P.S., VENTER, E., WINGFIELD, M.J. & MARASAS, W.F.O. (1987). Enteroblastic first macroconidia in *Fusarium crookwellense*. *Canadian Journal of Botany* **66**, 1364-1366.

WEIJMAN, A.C.M. & DE HOOG, G.S. (1974). On the subdivision of the genus *Ceratocystis*. *Antonie van Leeuwenhoek, Journal of Microbiology and Serology* **41**, 353-360.

WINGFIELD, M.J. (1985). Reclassification of *Verticicladiella* based on conidial development. *Transactions of the British Mycological Society* **85**, 81-93.

WINGFIELD, M.J., VAN WYK, P.S. & MARASAS, W.F.O. (1988). *Ceratocystiopsis proteae sp. nov.*, with a new anamorph genus. *Mycologia* **80**, 23-30.

WINGFIELD, M.J., VAN WYK, P.S. & VAN WYK, P.W.J. (1989). Conidial development in the anamorph of *Ophiostoma cucullatum*. *Mycological Research* **93**, 91-95.

WINGFIELD, M.J. VAN WYK, P.S. & WINGFIELD, B.D. (1987). Reclassification of *Phialocephala* based on conidial development. *Transactions of the British Mycological Society* **89**, 509-520.

MYCOTAXON

Volume XLVI, pp. 371-379 January-March 1993

CONIDIUM DEVELOPMENT IN THE SYNNEMATOUS ANAMORPHS OF OPHIOSTOMA.

MARNEL MOUTON & MICHAEL, J. WINGFIELD & P.S. VAN WYK
Department of Microbiology and Biochemistry, University of the Orange Free State, P.O. Box 339, Bloemfontein, 9300

The anamorph genera *Pesotum* and *Phialographium* were recently reduced to synonymy with *Graphium* following studies of their mode of conidium development. Because there was limited ultrastructural evidence in the latter study, the present study was undertaken to examine additional species. All species examined showed percurrent proliferation of conidiogenous cells which is a distinguishing characteristic of *Graphium* species. Results of this study reaffirm that *Graphium* is the only acceptable name for synnematous anamorphs of *Ophiostoma.*

INTRODUCTION

The *Graphium* complex has included the genera *Graphium* Corda, *Pesotum* Crane & Schoknecht and *Phialographium* Upadhyay & Kendrick, which are well established anamorphs of *Ceratocystis* Ellis & Halst., *Ophiostoma* H. & P. Sydow and related fungi (Upadhyay, 1981). Species in the *Graphium* complex are characterized by darkly pigmented, synnematous conidiophores, bearing complex conidiogenous apparatus, capped by slimy heads of conidia (Upadhyay, 1981). This group of fungi, including other species of *Ceratocystis sensu lato,* are well known causative agents of blue-stain in logs and lumber (Bakshi, 1951; Upadhyay, 1981), and exist in close association with insects, such as ambrosia beetles (Bakshi, 1950; Wingfield & Gibbs, 1991).

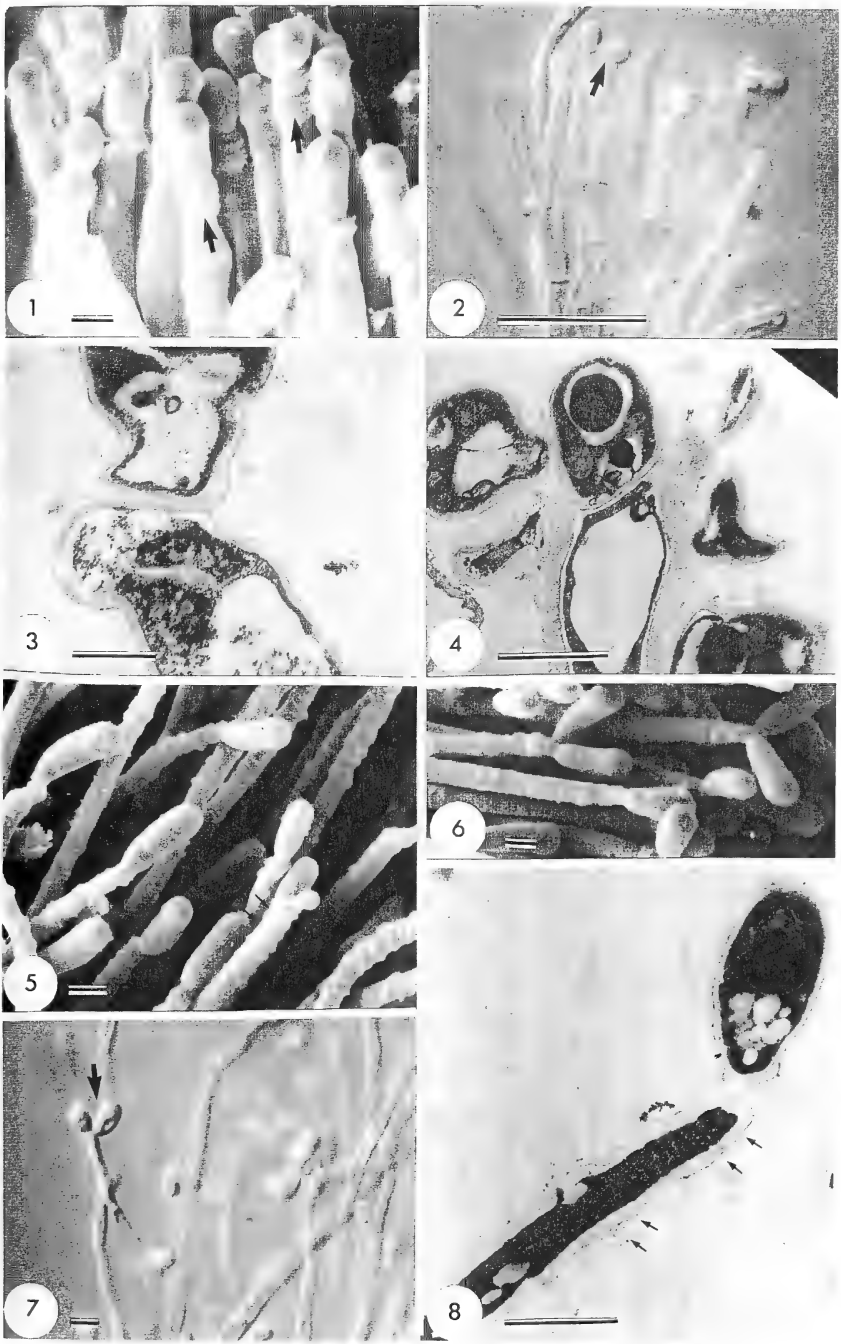
The genus *Graphium* was originally established for fungi with dark conidiophores that are penicillately branched with slimy heads of small aseptate, hyaline conidia (Corda, 1937). Corda's original description (1957) was amended by Saccardo (1886) and Goidànich (1935). However, after the establishment of conidium development as a taxonomic criterion by Hughes (1953), Crane and Schoknecht (1973) observed different modes of conidium development in *G. penicillioides* Corda, and the anamorphs of *O. ulmi* (Buisman) Nannf. and *O. piceae* (Münch) Syd. & P. Syd. The genus *Pesotum* was introduced for the anamorphs of the latter two species, to distinguish their sympodial conidial development from the annellated appearance of the conidiogenous cells of *G. penicillioides.* Upadhyay and Kendrick (1974) followed this trend when they established *Phialographium* for the *Graphium*-like anamorphs of *Ophiostoma* with phialidic conidiogenesis (Seifert & Okada, 1992).

During previous studies on the *Leptographium* Lagerberg & Melin -complex (the mononematous analogues of the *Graphium* complex), Wingfield (1985) reduced *Verticicladiella* Hughes to synonymy with *Leptographium.* This synonymy was based on studies showing that conidium development in *Verticicladiella* only had the appearance of being sympodial, when it was actually annellidic. Van Wyk, Wingfield and Marasas (1988) later showed that delayed secession of the newly formed conidia and the early onset of the successive proliferation stage sometimes results in the sympodial appearance of the conidiogenous cells in this group of fungi. This overlap in developmental stages eventually leads to conidia that are left hanging along the sides of the conidiogenous cell, creating an illusion of sympodial development. Wingfield, Kendrick and Van Wyk (1991) elaborated further on this view, and *Pesotum* and *Phialographium* were reduced to synonymy with *Graphium.* The latter study was, however, supported only by limited ultrastructural evidence from a few species. The aim of the present study was, therefore, to examine additional species in order to clarify this issue.

MATERIALS AND METHODS

Species examined included *Graphium ulmi* Schwarz, the type species of *Pesotum* obtained from the forest pathology culture collection of the Department of Plant Pathology, University of Minnesota; *Graphium piceae* (Crane & Schoknecht) Wingfield & Kendrick (= *Pesotum piceae*), from the culture collection of Dr. D.W. Davidson; the unnamed anamorph of *Ophiostoma olivaceum* Mathiesen, previously assigned to *Phialographium* by Upadhyay (1981) and from the collection of Dr. T. Hinds (C-382); the unnamed anamorph of *Ophiostoma davidsonii* (Olchowecki & Reid) Solheim (IMI 176524), formerly assigned to *Phialographium* by Upadhyay (1981); *Ophiostoma olivaceapinii* Davidson with an undescribed anamorph, which according to Upadhyay (1981) should be assigned to *Graphium*, from the forest pathology culture collection of the Department of Plant Pathology, University of Minnesota. All cultures were grown on 2 % malt extract agar (20 g Difco malt extract; 20 g Difco Bacto Agar; 1000 mL H_2O) in Petri dishes and incubated at 25 °C until the onset of sporulation.

Figs 1-8. Conidiogenous cells of the anamorph of *O. olivaceapinii* (Figs 1-4) and *Graphium ulmi* (Figs 5-8). **Fig. 1.** SEM of conidiogenous cells showing tightly packed annellations towards the apices (arrows) (Bar = 1 um). **Fig. 2.** Bright field micrograph showing the presence of incomplete dehiscence of newly formed conidia, giving a sympodial appearance to conidiogenous cells (arrow) (Bar = 10 um). **Fig. 3.** TEM of a section through a conidiogenous cell indicating an overlap in the stages of secession of the newly formed conidium and proliferation of the conidiogenous cell (Bar = 1 um). **Fig. 4.** TEM showing conidia left hanging along the sides of conidiogenous cells as a result of delayed secession (Bar = 0,5 um). **Fig. 5.** SEM showing annellations on the surface of the conidiogenous cells (arrows) as well as 'knobbly' structures that could be interpreted as sympodial development (arrowheads) (Bar = 1 um). **Fig. 6.** Annellated conidiogenous cells with newly formed conidia left hanging along the sides of the conidiogenous cells as a result of incomplete deshiscence (Bar = 1 um). **Fig. 7.** Bright field micrograph of a conidiogenous cell showing delayed secession of the newly formed conidium (arrow) (Bar = 1 um). **Fig. 8.** TEM of a section through a conidiogenous cell indicating annellations towards the apex (arrows) as well as delayed secession of the conidium (Bar = 1 um).


1
2
3
4
5
6
7
8

For bright field microscopy, fungal material was mounted on glass slides in lactophenol and photographed with Ilford FP4 film. Specimens for scanning electron microscopy (SEM) were cut from cultures in Petri dishes and fixed in 3 % glutaraldehyde, followed by 1 % osmium tetroxide for 2 h. Dehydration was performed in a graded acetone series, after which the material was critical point dried, mounted, coated with gold/palladium and viewed with a JSM 6400 scanning electron microscope.

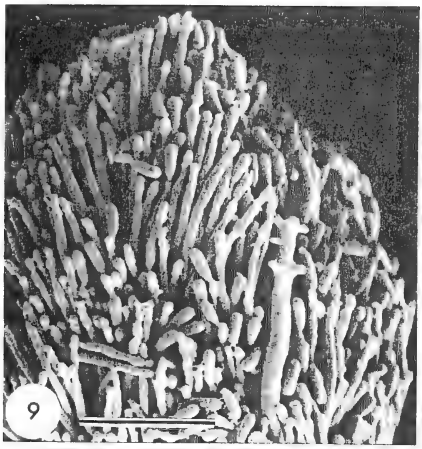
For transmission electron microscopy (TEM), the fixation and dehydration procedure was the same as that for SEM. Specimens were then embedded in epoxy resin (Spurr, 1969) and polymerized at 70 °C for 8 h. Sections (60 nm) were cut, mounted on copper grids, stained with uranyl acetate (20 - 30 min) and lead citrate (10 min) (Reynolds, 1963) and viewed with a Phillips EM 300 transmission electron microscope.

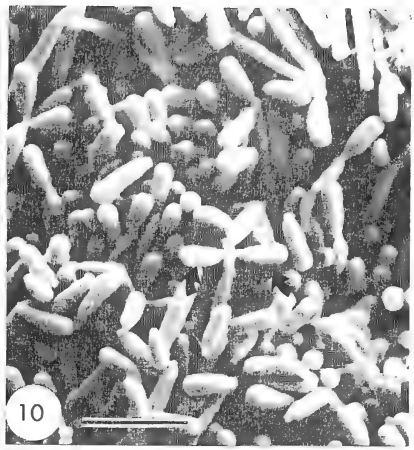
RESULTS AND DISCUSSION

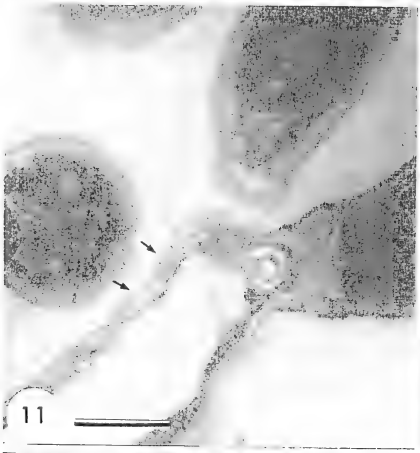
The anamorph of *O. olivaceapinii* was characterized by dark synnematous conidiophores (Davidson, 1971), with tightly packed, yet distinct annellations at the apices of hyaline conidiogenous cells, indicating percurrent proliferation (Fig. 1). Bright field micrographs gave the impression of sympodial conidial development where two or more conidia could be observed at the apices of conidiogenous cells (Fig. 2). However, TEM studies clearly showed that the stage of secession of newly formed conidia was repeatedly not completed, leaving newly formed conidia hanging along the sides of the conidiogenous cells, creating the illusion of sympodial conidial development (Figs 3, 4). Conidium development in the anamorph of *O. olivaceapinii* is therefore similar to that in *Leptographium procerum* (Kendrick) Wingfield, *L. terebrantis* Barras & Perry, and *L. truncatum* (Wingfield & Marasas) Wingfield (Van Wyk *et al.*, 1988), where the stages of secession and proliferation overlap. The result is annellidic conidium development that can easily be mistaken for sympodial ontogeny using light microscopy.

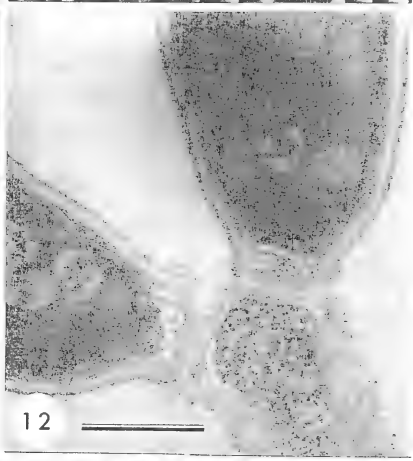
According to Crane and Schoknecht (1973), conidia in both *Graphium ulmi* and *G. piceae* are produced sympodially on short nodules or denticles. Hiratsuka and Takai (1978) made the same comment for *G. ulmi* in their study of this fungus. In the present study we observed the same sequence of events in *G. ulmi* (Figs 5-8) and *G. piceae* (Figs 9-12), as those in the anamorph of *O. olivaceapinii*. Annellations were, however, not as tightly packed (Figs 5, 6, 9, 10), as in the latter species. No short denticles or nodules, as noted by Crane & Schoknecht (1973) and Hiratsuka & Takai (1978), were observed. We did, however note the presence of 'knobbly' scars on some of the conidiogenous cells in *G. ulmi* (Fig. 5) which could indicate sympodial development. The same structure could be observed in the transmission electron micrograph. However, annellations were distinctly visible in the same micrograph (Fig. 8).

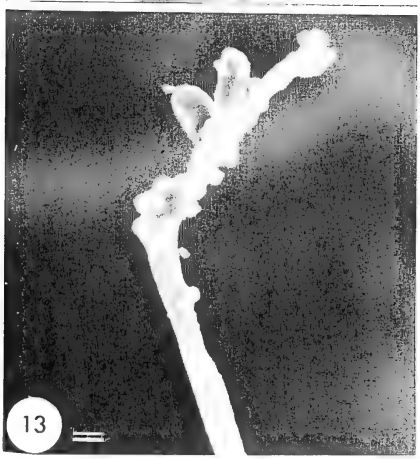
Figs 9-14. Conidiophore and conidiogenous cells of *Graphium piceae* and *G. ulmi*. **Fig. 9.** SEM of the synnematous, sheathed conidiophore of *G. piceae* showing conidiogenous cells with apparent sympodial conidial development (arrows) (Bar = 10 um). **Fig. 10.** SEM of the conidiogenous cells of *G. piceae,* showing conidia left hanging along the sides of the conidiogenous cells resulting from delayed secession (arrow) (Bar = 10 um). **Fig. 11, 12.** TEM of sections through conidiogenous cells indicating annellations towards the apices (arrows), as well as delayed secession of the conidia (Bars = 1 um). **Fig. 13.** SEM of the *Sporothrix* synanamorphic state of *G. ulmi* (Bar = 1 um). **Fig. 14.** *Sporothrix* synanamorph of *G. piceae* (Bar = 10 um).

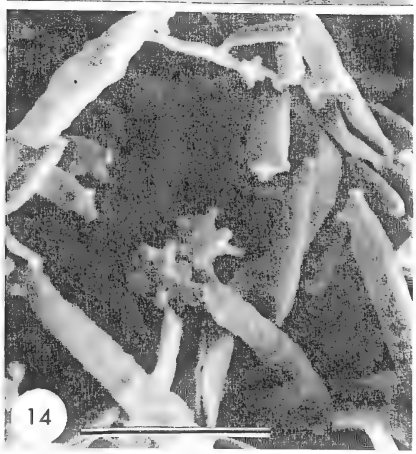

9

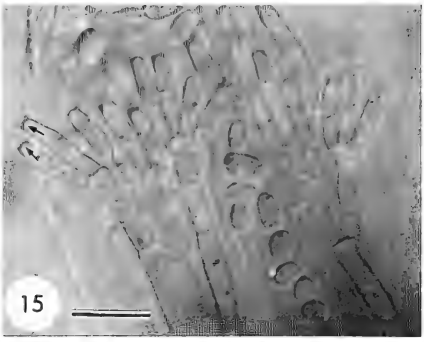

10

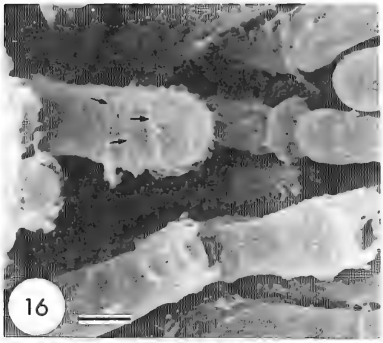

11


12

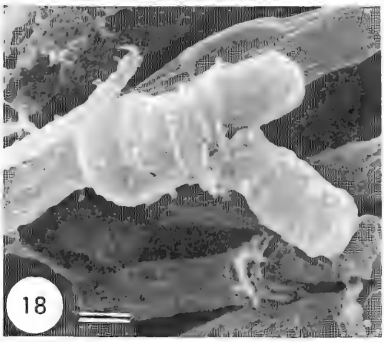

13

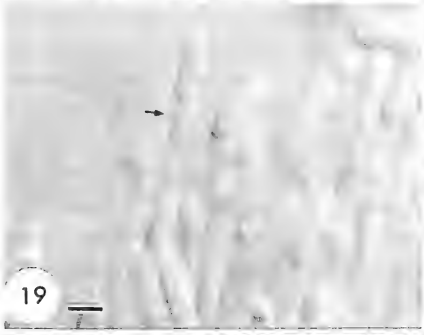

14

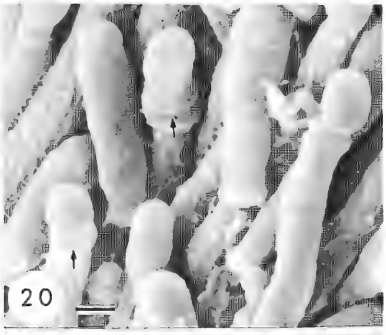

15

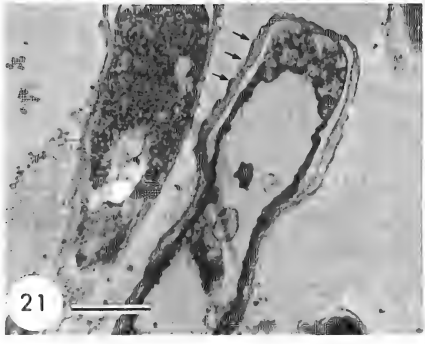

16

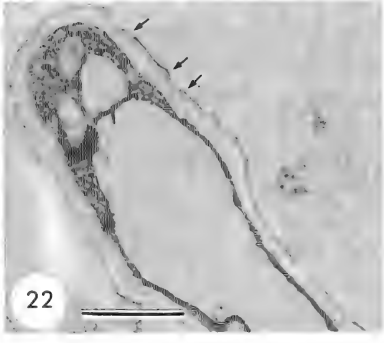
17


18


19


20


21


22

We, therefore, confirm the reassignment of these two species to *Graphium* (Wingfield *et al.,* 1991). *G. ulmi* and *G. piceae* were also characterized by the presence of sympodial *Sporothrix* Hekt. & Perkins synanamorphic states (Figs 13, 14), a common feature among *Graphium* anamorphs of *Ophiostoma* (De Hoog, 1974).

The unnamed anamorph of *O. davidsonii* has been described by Olchowecki and Reid (1974) as being synnematous with phialidic conidiogenous cells. Upadhyay (1981), therefore, stated that it was a species of *Phialographium*. Bright field micrographs showed that the conidiogenous cells of the anamorph of *O. davidsonii* appeared to be phialidic with small collarettes and periclinal thickening towards the inside of the cell (Fig. 15). However, SEM and TEM studies clearly showed distinct annellations towards the apices of conidiogenous cells (Figs 16, 17). Scanning electron micrographs also indicated the presence of incomplete deshiscence of newly formed conidia, giving a sympodial appearance to such conidiogenous cells (Fig. 18), whereas TEM studies verified the occurrence of sympodial or angled percurrent proliferation in terms of Wingfield *et al.* (1991) (Fig. 17). This study reaffirms that the placement of the anamorph of *O. davidsonii* in *Phialographium* was incorrect and that it should be assigned to *Graphium* as suggested by Wingfield *et al.* (1991).

Another anamorph accepted as a species of *Phialographium* is that of *O. olivaceum* (Upadhyay, 1981). Olchowecki and Reid (1974) also noted that the morphology of the 'phialides' and the arrangement of the individual stalks composing the synnema of this fungus, were very similar to that of the anamorph of *O. davidsonii.* Neither Mathiesen (1951), nor Hunt (1956), discussed the mode of conidiogenesis in their descriptions of the fungus, although it appears to be phialidic in Mathiesen's (1951) schematic representations. It was difficult to interpret with certainty the nature of the conidiogenous cells from bright field or SEM studies because the apices of these cells were characterized by a prominent widening (Figs 19, 20). From these micrographs the conidiogenous cells appeared to be phialidic. TEM studies, however, showed the presence of annellations on the surface of the widened apices of the conidiogenous cells. This anamorph should, therefore, also be assigned to *Graphium.*

This study has reaffirmed that anamorphs of *Ophiostoma* assigned to the *Graphium* complex cannot be further segregated on the basis of mode of conidium development. *Graphium* can, therefore, be the only acceptable name for synnematous anamorphs of *Ophiostoma.*

Figs 15-22. Conidiogenous cells of the unnamed anamorph of *O. davidsonii* (figs 15-18) and *O. olivaceum* (Figs 19-22). **Fig. 15.** Bright field micrograph showing apparent phialidic conidiogenous cells with periclinal thickening towards the apices (arrows) (Bar = 10 um). **Fig. 16.** SEM revealing the presence of distinct annellations towards the apices of the conidiogenous cells (arrows) (Bar = 1 um). **Fig. 17.** TEM of a section through a conidiogenous cell showing distinct annellations at the apex (arrows) (Bar = 0,5 um). **Fig. 18.** Example of incomplete secession of a newly formed conidium resulting in an illusion of sympodial conidial development (Bar = 1 um). **Fig. 19.** Light microscopy showing a widening towards the apex of the conidiogenous cell (arrow) (Bar = 1 um). **Fig. 20.** SEM of conidiogenous cells with a prominent widening at the apex (arrows) (Bar = 1 um). **Fig. 21, 22.** TEM of sections through the conidiogenous cell showing the presence of annellations on the surfaces of the widenings at the apices (arrows) (Bars = 0,5 um).

Other synnematous anamorphs such as *Graphilbum* Upadhyay & Kendrick, *Hyalopesotum* Upadhyay & Kendrick and *Graphiocladiella* Upadhyay are separated from *Graphium* species only on the basis of pigmentation and spore septation. They will also have to be examined to clarify whether it is justifiable to separate them from *Graphium.*

ACKNOWLEDGMENTS

Financial support from the Foundation for Research Development is gratefully acknowledged. We also thank Dr. W.B. Kendrick for his constructive review of this manuscript.

REFERENCES

BAKSHI, B.K. (1950). Fungi associated with ambrosia beetles in Great Britain. *Transactions of the British Mycological Society* **33**, 111-120.

BAKSHI, B.K. (1951). Studies on four species of *Ceratocystis*, with a discussion on fungi causing sap-stain in Britain. *Commonwealth Mycological Institute Mycology Research Paper* **35**, 1-16.

CORDA, A.K.J. (1937). *Icones fungorum* **1**, 1-32. Prague.

CRANE, J.L. & SCHOKNECHT, J.D. (1973). Conidiogenesis in *Ceratocystis ulmi, Ceratocystis piceae* and *Graphium penicillioides. American Journal of Botany* **60**, 346-354.

DAVIDSON, R.W. (1971). New species of *Ceratocystis. Mycologia* **63**, 5-15.

DE HOOG, G.S. (1974). The genera *Blastobotrys, Sporothrix, Calcarisporium* and *Calcarisporiella* gen. nov. *Studies in Mycology* **7**, 1-88.

GOIDÀNICH, G. (1935). Schema di una classificazione delle Stilbacee che erano riunite fin'ora nel genere *Graphium* Corda. *Annual Botany (Torino)* **21**, 40-50.

HIRATSUKA, Y. & TAKAI, S. (1978). Morphology and morphogenesis of synnemata of *Ceratocystis ulmi. Canadian Journal of Botany* **56**, 1909-1914.

HUGHES, S.J. (1953). Conidiophores, conidia and classification. *Canadian Journal of Botany* **31**, 577-659.

HUNT, J. (1956). Taxonomy of the genus *Ceratocystis. Lloydia* **19**, 1-58.

MATHIESEN, A. (1951). Einige neue *Ophiostoma*-arten in Schweden. *Svensk Botanisk Tidskrift* **45**, 203-232.

OLCHOWECKI, A. & REID, J. (1974). Taxonomy of the genus *Ceratocystis* in Manitoba. *Canadian Journal of Botany* **52**, 1675-1711.

REYNOLDS, E.S. (1963). The use of lead citrate at high pH as an electron-opaque stain in electron microscopy. *Journal of Cell Biology* **17**, 208-212.

SACCARDO, P.A. (1886). Sylloge funforum omnium hucusque cognitorum. Vol IV. Padova.

SEIFERT, K.A. & OKADA, G. (1992). *Graphium* anamorphs of *Ophiostoma* species and similar anamorphs of other Ascomycetes. In *Ceratocystis and Ophiostoma: Taxonomy, ecology and pathogenicity* (ed. M.J. Wingfield, K.A. Seifert and J.F. Webber) pp.24-38. In Press.

SPURR, A.R. (1969). A low viscosity embedding medium for electron microscopy. *Journal of Ultrastructural Research* **26**, 31-43.

UPADHYAY, H.P. (1981). *A monograph of* Ceratocystis *and* Ceratocystiopsis. Athens: The University of Georgia Press.

UPADHYAY, H.P. & KENDRICK, B.C. (1974). A new *Graphium*-like genus (conidial state of *Ceratocystis). Mycologia* **66**,181-183.

VAN WYK, P.S., WINGFIELD, M.J. & MARASAS, W.F.O. (1988). Differences in synchronization of stages of conidial development in *Leptographium* species. *Transactions of the British Mycological Society* **90**, 451-456.

WINGFIELD, M.J. (1985). Reclassification of *Verticicladiella* based on conidial development. *Transactions of the British Mycological Society* **85**, 81-93.

WINGFIELD, M.J. & GIBBS, J.N. (1991). *Leptographium* and *Graphium* species associated with pine-infesting bark beetles in England. *Mycological Research* **95**, 1257-1260.

WINGFIELD, M.J., KENDRICK, B. & VAN WYK, P.S. (1991). Analysis of conidium ontogeny in anamorphs of *Ophiostoma*: *Pesotum* and *Phialographium* are synonyms of *Graphium*. *Mycological Research* **95**, 1328-1333.

MYCOTAXON

Volume XLVI, pp. 381-385 January-March 1993

OPHIOSTOMA BRAGANTINUM N. SP., A POSSIBLE TELEOMORPH OF *SPOROTHRIX INFLATA*, FOUND IN BRAZIL.

Ludwig Pfenning und Franz Oberwinkler

Botanisches Institut, Lehrstuhl Spezielle Botanik / Mykologie, Universität Tübingen, Auf der Morgenstelle 1, D-7400 Tübingen, Germany.

Introduction

During an investigation on soil microfungi in the Eastern Amazon an *Ophiostoma* species was isolated from washed soil particles which does not fit with the description of any known species (Hunt, 1956; Upadhyay, 1981; Griffin, 1966; Olchowecki & Reid, 1974). The segregation of *Ophiostoma* from *Ceratocystis* as proposed by de Hoog & Scheffer (1984) has been vindicated by partial sequencing of small subunit rDNA (Spatafora & Blackwell, 1992). The anamorph of the new taxon is close to a Hyphomycete known as *Sporothrix inflata* de Hoog (1974; type strain CBS 239.68) or *Humicola dimorphospora* Roxon & S. Jong (1974; type strain CBS 553.74), for which no teleomorph was so far known.

Ophiostoma bragantinum Pfenning & Oberwinkler *sp. nov.* —Fig. 1

Coloniae in agaro farina avenae confecto at 20 mm diam. post 10 dies 20 °C. Mycelium hyalinum, coloniae reversum incoloratum. Ascomata copiosa post 15 dies, atra; parte basilari globosa, 130–220 μm diam., hyphis pigmentatis, septatis, simplicibus, ad 1.5 μm latis circumdata, in agaro submersa, collo 700–1200 μm longo, e 25 μm in parte inferiore ad 12–16 μm sursum angustata, coma hypharum hyalinarum ad 45 μm longarum coronato. Asci obovati, 10–12 x 6–7 μm. Ascosporae ovales vel

reniformes, dilute pigmentatae, 3–3.2 × 1.5 μm. Sporae in summo ascomate in massa cremea mucida aggregatae. Species homothallica.

Holotypus Herb. CBS 474.91, isolatus e terra in sylva primaria, Capitão Poço, Pará in Brasilia lecta, in Herb. CBS praeservatus.

Teleomorph: Colonies on oatmeal agar (OA) and potato-carrot agar (PCA) reaching 20 mm diam in 10 days at 20–22°C. Mycelium hyaline, colony reverse colourless. Ascomata produced abundantly after two weeks at 20–30°C, black, basal part globose, 130–220 μm diam, with pigmented, septate, unbranched, up to 1.5 μm wide hairs, immersed in the substratum; bearing a 700–1200 μm long erect neck, tapering from about 25 μm in the lower part to 12–16 μm, and terminating in a distinct fringe of hyaline ostiolar hairs, up to 45 μm long. Asci clavate when young, obovate at maturity, evanescent, 10–12 x 6–7 μm. Ascospores reniform, faintly pigmented at maturity, 3–3.2 × 1.5 μm. Spores forming a cream-coloured slimy head at the tip of the ascoma. Homothallic.

Anamorph: Close to *Sporothrix inflata* de Hoog. The only difference are the occasionally slightly roughened, pigmented blastoconidia. Conidiophores erect, 20–40 μm tall, forming distinct head-like structures with numerous conidiiferous denticles, about 0.8–1.5 × 0.5 μm. Sometimes the conidiophores are so short, that the conidia are almost sessile on the vegetative hyphae. Conidia hyaline, guttuliform or fusiform, pointed at the base, hyaline, smooth-walled, 4–6 × 2–2.5 μm. Lateral, mostly pigmented blastoconidia abundant, immersed or superficial, globose, slightly roughened, about 4 μm diam.

Temperature relationships: *O. bragantinum*: optimum (21–)27(–30)°C, maximum above 30°C, *S. inflata* (CBS 239.68) optimum 24°C, maximum near 30°C, *H. dimorphospora* (CBS 553.74) optimum 21–24°C, maximum idem.
Etymology: Bragantina, a geographical region in the state of Pará, Brazil.

Material examined

CBS 474.91 (type strain), CBS 430.92, CBS 431.92, from soil under primary forest, Brazil, Pará, Capitão Poço – leg. L. Pfenning, December 1990.

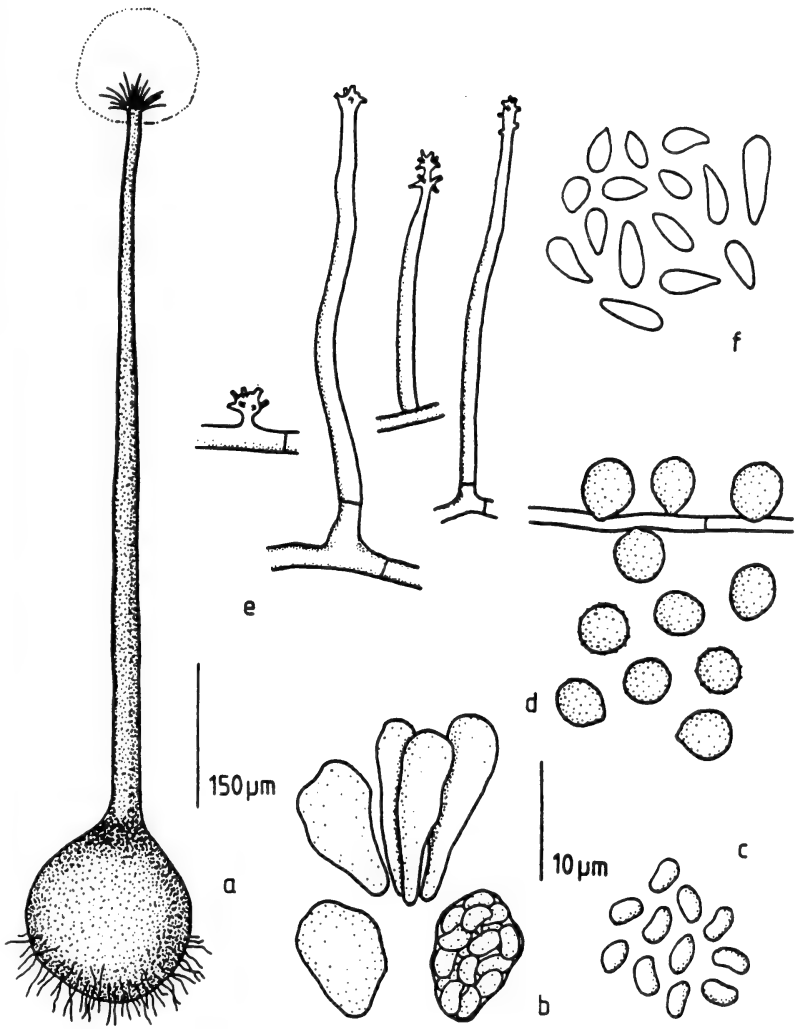


Fig. 1. *Ophiostoma bragantinum*, a. ascocarp, b. asci, c. ascospores, d. pigmented, sessile conidia, e. conidiophores, f. hyaline conidia.

Discussion

Sporothrix inflata (= *Humicola dimorphospora*) is a common soil fungus in temperate regions (de Hoog, 1974; Domsch et al., 1980). So far its teleomorph is not known. Ascomata of *O. bragantinum* are also produced in single-spore cultures, hence this species is homothallic. The genetic distance between the two taxa has not yet been established. The ornamentation of the pigmented blastoconidia in *O. bragantinum* is the only morphological difference so far observed. Its temperature optimum is also slightly higher.

Similar species of *Ophiostoma* include *O. stenoceras* Robak (1932) and *O. tetropii* Mathiesen (1951). *O. tetropii* has allantoid ascospores, 3–4 × 1.5–2 μm, the anamorph is indistinguishable from *Sporothrix schenckii* Hektoen & Perkins (de Hoog, 1974). The former has orange-section-shaped ascospores measuring 3–4.5 × 1.8–2.2 μm, the anamorph is *S. schenckii* (de Hoog, 1974; Upadhyay, 1981). *O. albidum* Mathiesen-Käärik (1951; Hunt, 1956) is considered a synonym of *O. stenoceras* (de Hoog, 1974; Upadhyay, 1981).

Two recently described species from Roraima State (North Amazonia, Brazil), *O. roraimense* Samuels & E. Müller and *O. grande* Samuels & E. Müller (Samuels & Müller, 1978), are quite different.

The authors are indebted to Dr W. Gams who provided the Latin diagnosis and revised the manuscript. This work was supported by the Deutscher Akademischer Austauschdienst (DAAD).

References

Domsch, K. H., Gams, W. & Anderson, T. H., 1980. Compendium of soil fungi. Academic Press, London, Vol. I, 860pp.

Griffin, H. D., 1968. The genus *Ceratocystis* in Ontario. Can. J. Bot. 46: 689–718.

Hoog, G. S. de, 1974. The genera *Blastobotrys, Sporothrix, Calcarisporium* and *Calcarisporiella* gen. nov.. Stud. Mycol. 7, 84 pp.

Hoog, G. S. de & Scheffer, R. J., 1984. *Ceratocystis* versus *Ophiostoma:* a reappraisal. Mycologia 76: 292–299.

Hunt, J., 1956. Taxonomy of the genus *Ceratocystis*. Lloydia 19: 1–59.

Mathiesen, A., 1951. Einige neue *Ophiostoma*-Arten in Schweden. Svensk Bot. Tidskr. 45: 203–232.

Olchowecki, A. & Reid, J., 1974. Taxonomy of the genus *Ceratocystis* in Manitoba. Can. J. Bot. 52: 1675–1711.

Robak, H., 1932. Investigations regarding fungi on Norwegian ground wood pulp and fungal infection at wood pulp mills. Nytt Mag. Naturvid. 71: 185–330.

Roxon, J. E. & Jong, S. C., 1974. A new pleomorphic species of *Humicola* from Saskatchewan soil. Can. J. Bot. 52: 517–520.

Samuels, G. J. & Müller, E., 1978. Life history study of Brazilian ascomycetes 5. Sydowia 31: 169–179.

Spatafora, J.W. & Blackwell, M., 1992. Monophyly and higher level systematics of ascomycetes. Inoculum (Mycol. Soc. Am. Newsl.) 43: 50 (abstract).

Upadhyay, H.P., 1981. A Monograph of *Ceratocystis* and *Ceratocystopsis*. Univ. Georgia Press, Athens, 176 pp.

MYCOTAXON

Volume XLVI, pp. 387-402 January-March 1993

SOME PYRENOMYCETES ON THREE ERICACEOUS HOSTS IN WESTERN NORTH AMERICA

MARGARET E. BARR

9475 Inverness Avenue, Sidney, British Columbia, Canada V8L 5G8

SUMMARY

According to literature sources and collections, three ericaceous plants in western North America, *Arbutus menziesii, Gaultheria shallon, Vaccinium parvifolium*, are hosts to 48, 24, and nine species of pyrenomycetous fungi respectively. Newly described are *Ditopellopsis linearis, Hyponectria fusispora, Pseudomassaria hesperia, Splanchnonema arbuti, S. vaccinii, Chaetomastia littoralis, Sinodidymella occidentalis, Teichospora hesperia.* The new combination *Biscogniauxia exutans* (Cooke) Barr is proposed.

Whereas inventories of many different taxa are available for much of temperate North America, knowledge of pyrenomycetous saprobes and hemibiotrophs is sporadic in much of the continent. Intensive collecting in a restricted area reveals an assortment of undescribed species and extends the geographic and host ranges of known taxa. Historical examples are collections made by L. de Schweinitz in Pennsylvania, J. B. Ellis in New Jersey, and C. H. Peck in New York. To illustrate these statements in modern times, I report on investigations of three members of the Ericaceae in southern Vancouver Island, British Columbia. This study was presented as a poster at the annual meetings of MSA in Portland OR, Aug 1992 and is expanded here, in part to describe several new taxa.

Arbutus menziesii Pursh (Pacific madrone, arbutus) is the largest species in the Ericaceae, a tree of coastal southern British Columbia, Washington, Oregon and northern California. It is conspicuous among the predominant gymnosperms on Vancouver Island by its peeling periderm that exposes a smooth, reddish trunk and branches, broad "evergreen" leaves and masses of whitish flowers and bright orange-red fruit in season. *Gaultheria shallon* Pursh (salal) is an undergrowth shrub that can reach 2 m or more in height but more often produces dense patches of

entangled low branches, leathery, long-lived leaves, pink, urceolate flowers, and glaucous blackish fruits. *Vaccinium parvifolium* Sm. (red huckleberry) is a less conspicuous shrub, having slender, angled stems and small, deciduous leaves, small, greenish-pink flowers, and small, bright red fruits.

The pyrenomycetous species previously reported on these substrates in the Pacific coastal area were summarized by Eglitis et al. (1966). They listed two species on *Arbutus*, eight (seven when corrected) on *Gaultheria*, and one on *Vaccinium*. Ginns (1986) added two on *Arbutus*, one on *Gaultheria*. Farr et al. (1989) listed six additional species on *Arbutus*. [*Dothidea rugodisca* Cooke & Harkness (*Homostegia* Sacc.) was described from California on *Arbutus*. This is a doubtful species, sterile according to the isotype, perhaps conidial according to Theissen and Sydow (1915), and is excluded from the list.] A total of nine species on *Arbutus*, eight on *Gaultheria* and one on *Vaccinium* was recognized until recently. My collections bring the numbers of pyrenomycetous species to 48 on *Arbutus*, 24 on *Gaultheria*, and nine on *Vaccinium*. Some of these are on more than one host genus so that the total number of species listed below is 65. All of the pyrenomycetes now recognized on these host plants (designated by the initials A, G, V) in the province or state where found (abbreviated) are listed below and are arranged under the orders accepted by Barr (1987, 1990b) and recent unpublished emendations. The earlier citations noted above are given as the three dates 1966, 1986, and 1989, while MEB and numbers refer to Barr collections deposited in DAOM or NY, except as noted in the text.

HYMENOASCOMYCETES

Erysiphales, Erysiphaceae:
Microsphaera vaccinii (Schwein.) Cooke & Peck [and reported as *M. penicillata* (Wallr.: Fr.) Lév. or var. *vaccinii*; Parmelee 1977] G: AK (1966), BC (1986), OR, WA (1989); V: AK, WA (1966, 1989).

Meliolales, Meliolaceae:
Meliola neissleana Winter [and reported as *M. nidulans* (Schwein.) Cooke, which occurs on *Cornus*; Hansford 1961] G: CA, OR, WA (1966, 1989).

Diaporthales, Diaporthaceae:
Diaporthe eres Nitschke A: BC (MEB 7367, 7693, 7820, 7956, 8153). The most common species of *Diaporthe* in British Columbia, on many woody substrates.
Diaporthe pardalota (Mont.) Fuckel A: BC (MEB 8111); G: BC (MEB 7225, 7246, 7285, 7385, 7591, 7616, 8039, 8084, 8093, 8162); V: BC (MEB 7320, 7595, 7717, 7735). This species forms blackened areas on stems of various woody

and herbaceous plants; these stromatic areas are delimited in the substrate by a blackened ventral zone.
Diaporthe vaccinii Shear G: WA (1966, 1989).
Ditopellopsis linearis Barr, sp. nov. Fig. 1a-e

Ascomata gregaria in seriebus elongatis immersa globosa vel sphaeroidea 200-400 µm diametro, rostra 100-250 µm longa 100-150 µm lata, ostiola periphysata, strata stromatica cellularum compressorum brunnorum 15-25 µm lata. Asci unitunicati 55-80 x 9-12 µm ellipsoidei, annuli apicali refractivi. Ascosporae 12-15 x 5-6 µm hyalinae ellipsoideae uniseptatae appendiculatae biseriatae. Holotypus in ramis *Gaultheriae shallonis* "British Columbia, Sidney, 9 Apr 1991" a M. E. Barr n. 7509 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata gregarious in longitudinal rows in series of one or two, immersed and splitting periderm lengthwise, exposing short wide black beaks, globose or sphaeroid, 200-400 µm diam; beaks 100-250 µm long, 100-150 µm wide, ostiole periphysate; peridium of beak and body surrounded closely by stromatic layer of blackish, small, pseudoparenchymatous cells, 35-55 µm wide, peridium 15-25 µm wide, compressed rows of brown to hyaline cells. Asci 55-80 x 9-12 µm, ellipsoid, unitunicate, floating free in centrum; apical ring refractive, chitinoid. Remnants of centrum tissue 3-6 µm wide, distantly septate. Ascospores 12-15 x 5-6 µm, hyaline, ellipsoid, one-septate median, slightly constricted; wall smooth or lightly foveolate, bearing narrow terminal appendages 3-8 µm long; two globules per cell; overlapping biseriate in the ascus.

In branches of *Gaultheria shallon*. Additional collections: British Columbia: Sidney, MEB 7546, 7593, 7617, 7719, 8096, 8166.

Ditopellopsis linearis has somewhat elongate appendages but smaller ascospores than *D. alni* (Thompson & Miller) Barr and the beaks are not so elongate. The other two species, *D. clethrae* Reid & Booth and *D. racemula* (Cooke & Peck) Barr, have narrower ascospores that bear short appendages (Barr 1978). A search of species under *Diaporthe* (Wehmeyer 1933) provided only one species having seriately arranged ascomata, *D. linearis* (Nees) Nitschke. This fungus on stems of Asteraceae has long-beaked ascomata beneath slightly blackened substrate tissues, smaller asci and ascospores that bear short appendages; it certainly differs from the fungus on *Gaultheria*.

Melanconidaceae:
Massariovalsa californica (Wehmeyer) Barr A: CA (1989). Known to me only from the type collection; described by Wehmeyer (1941) and Barr (1978).
Wuestniopsis sp. This undescribed taxon is the subject of a separate publication (Reid and Barr, in preparation).

Valsaceae:
Valsa ceratosperma (Tode: Fr.) Maire [and reported as

Valsa delicatula Cooke & Ellis or *Valsa* sp.] A: OR, WA, BC (1966, 1986, 1989, MEB 7155, 7278, 7484, 7630, 7686, 7783, 7790, 7804, 8062, 8186); G: BC (MEB 7224). Common, especially the anamorph, on dying twigs and branches of various woody dicots.

Sordariales, Lasiosphaeriaceae:
Lasiosphaeria cfr. ***munkii*** R. & O. Hilber A: BC (MEB 7361). This species has geniculate ascospores with a slightly bulbous lower tip. The ascomata bear distinctive, pallid, thick-walled, short appendages. It was described from Virginia and Denmark (Hilber et al. 1987) and I have made collections in Quebec [on *Gaultheria hispidula* (L.) Muhl.] and Maine.

Hypocreales, Hypocreaceae:
Nectria cinnabarina (Tode: Fr.) Fr. A: BC (MEB 7480).

Niessliaceae:
Trichosphaerella decipiens Bommer, Roussel & Sacc. A: BC (MEB 7409).

Xylariales, Amphisphaeriaceae:
Amphisphaerella sp. (Fig. 1f-h) A: BC (MEB 7754). One small collection has ascospores with an unique longitudinal arrangement of four pores, quite different from the equatorial, terminal or scattered pores in the other species. More material is needed before the taxon is described and the collection is retained until that time.

Clypeosphaeriaceae:
Clypeosphaeria mamillana (Fr.) Lambotte A: BC (MEB 8941). This species occurs on various substrates in British Columbia, most commonly on *Quercus garryana* Douglas, in addition to Europe (Barr 1989b).
Melomastia mastoidea (Fr.) Schröter (Fig. 1i-k) A, G: BC (MEB 7395, 7955). This fungus is common locally on dead branches of various trees, shrubs and woody vines. The hyaline, two-septate ascospores are most distinctive.

Diatrypaceae:
Diatrype prominens Cooke & Harkness A: CA (1989); BC (MEB 7478, 7741, 8100).

Hyponectriaceae:
Hyponectria fusispora Barr, sp. nov. Fig. 1l-n

Ascomata immersa dispersa vel gregaria hypophylla globosa 125-190 µm diametro, papillae minutae, ostiola periphysata, peridia cellularum compressorum 10 µm lata brunnea vel denigrita in partum superis. Asci unitunicati, 36-70 x (6-)8-13 µm oblongi, annuli apicali amyloidei. Paraphyses deliquescens. Ascosporae 14-18 x 3-4 µm hyalinae oblongae fusoideae unicellularae vel uniseptatae biseriatae vel triseriatae. Holotypus in

foliorum *Arbuti menziesii* "British Columbia, Sidney, 10 Nov 1991" a M. E. Barr n. 7846 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata immersed, scattered to gregarious, hypophyllous, globose, 125-190 µm diam; papilla short and inconspicuous in rounded apex, ostiole periphysate; peridium brown, blackened around ostiole and upper sides as small clypeus, ca. 10 µm wide, compressed rows of cells. Asci 36-70 x (6-)8-13 µm, oblong, unitunicate; apical ring shallow, amyloid. Paraphyses delicate, deliquescent. Ascospores 14-18 x 3-4 µm, hyaline, oblong fusoid, straight or inequilateral, one celled or delicately one-septate; wall smooth; guttulate or 3-4 globules; overlapping biseriate to triseriate in the ascus.

In dead leaves of *Arbutus menziesii* and *Gaultheria shallon*. Additional collections: British Columbia: Sidney, MEB 7845 with *Anthostomella unguiculata*. USA: California: Mendocino Co., Jackson State Forest, 3 Dec 1971, M. E. Barr 5936b (DAOM, NY).

This species is most similar in sizes to *H. buxi* (DC.) Sacc. but the ascospores are narrower and more fusoid. The ascospores of both species may develop a delicate median septum.

Leiosphaerella praeclara von Höhnel (Fig. 1o) G: BC (MEB 7287, 8172). These collections match well the type material on *Vaccinium* from Austria. The ascospores may develop one or two additional septa.

Pseudomassaria hesperia Barr, sp. nov. Fig. 1p-r

Ascomata immersa dispersa vel gregaria sphaeroidea 250-300 µm lata 200-250 µm alta, papillae humiles, ostiola periphysata, peridia cellularum compressorum brunneae 15-20 µm lata denigrata et 30 µm lata in partum superis. Asci unitunicati 70-100 x 15-20 µm ellipsoidei, annuli apicali amyloidei. Paraphyses deliquescens. Ascosporae 25-30(-32) x 6-8(-10) µm hyalinae vel in caespi flavorum obovoideae fusoideae uniseptatae basin versus biseriatae. Holotypus in ramis et foliis *Gaultheriae shallonis* "British Columbia, Mill Bay, 11 Dec 1990" a M. E. Barr 7393 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata immersed, scattered evenly or gregarious, sphaeroid, 250-300 µm wide, 200-250 µm high; low papilla to surface, ostiole periphysate; peridium of compressed rows of cells, brown, 15-20 µm wide, blackened and up to 30 µm wide toward apex. Asci 70-100 x 15-20 µm; apical ring shallow, amyloid. Paraphyses wide, guttulate, deliquescent. Ascospores 25-30(-32) x 6-8(-10) µm, hyaline, yellowish in mass, obovoid fusoid, ends acute, narrowed to base, 1-septate in lower third, not or slightly constricted, lower cell 7-10 µm long; wall smooth, gel coating at times; guttulate then 2-4 globules; overlapping biseriate in the ascus.

In thin branches and dead leaves of *Gaultheria shallon*; branches of *Vaccinium parvifolium*. Additional

collections: British Columbia: Sidney: G: 7226, 7247, 7286, 7464, 7592, 7875, 7921, 8176; V: 7397, 7528, 7879, 7931, 8222.

Pseudomassaria hesperia is closest to *P. corni* (Niessl) v.Arx (Barr 1964) in ascospore sizes and in development in thin branches. The ascospores of *P. corni* have obtuse ends rather than the acute ones of *P. hesperia*.

Xylariaceae:

Two species of *Anthostomella* have separate ascomata beneath small clypei and uniseptate ascospores whose lower cell is much shorter and paler than the upper.

Anthostomella tomicoides Sacc. A: BC (MEB 8055). This is another host plant for the species; the collection agrees well with specimens on *Rubus*.

Anthostomella unguiculata (Mont.) Sacc. A: BC (MEB 7845, 7894, 8006, 8156). This small species occurs infrequently in coriaceous leaves. Francis (1975) redescribed the fungus on *Desfontainia* in Chile, *Quercus* in Belgium and *Magnolia* in USA (Louisiana).

Two other taxa on *Arbutus* have gregarious ascomata that develop beneath blackened surface of wood; the blackening at times extends laterally in the wood. One forms nearly globose ascomata and ellipsoid, symmetric ascospores 18-22(-24) x 10-11 µm (Fig. 1s-u). Rappaz (personal communication) suggests that this taxon may be referrable to *Anthostoma cfr. sustentum* Plowright, a species described from *Arctostaphylos* in California. The second taxon has more deeply immersed, more ovoid ascomata and more fusoid, asymmetric ascospores, 18-25 x 9-10 µm (Fig. 1v-x). It may be that these are only variations of a single species, but the consistently slight differences of ascoma and ascospore shapes suggest otherwise. The collections are retained until a definite disposition can be made.

Biscogniauxia exutans (Cooke) Barr, comb. nov.

Diatrype exutans Cooke, J. Linn. Soc. London 17: 143. 1878.

Anthostomella exutans (Cooke) Sacc. Syll. Fung. 1:

Fig. 1. a-e. *Ditopellopsis linearis*: a, habit of ascomata, b, ascoma in section, c, portion of stroma and peridium, d, ascus, e, ascospores. f-h. *Amphisphaerella* sp.: f, habit of ascomata, g, ascus apex, h, ascospore. i-k. *Melomastia mastoidea*: i, habit of ascomata, j. ascus apex, h, ascospores. l-n. *Hyponectria fusispora*: l, ascoma in outline, m, ascus, n, ascospores. o. *Leiosphaerella praeclara*, ascospores. p-r. *Pseudomassaria hesperia*: p, ascoma in outline, q, ascus, r, ascospores. s-u and v-x. *Anthostomella* spp.: s, v, habit of ascomata, t, w, ascus apices, u, x, ascospores. Standard line = 15 µm for asci, ascospores and cells, 150 µm for ascomata. Habit sketches not to scale.

a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x

196. 1882.
Nummularia exutans (Cooke) Cooke, Grevillea 12: 8. 1883.
Hypoxylon nummularium Bull.: Fr. var. *exutans* (Cooke) Miller, World Species of *Hypoxylon* 124. 1961.
Numulariola exutans (Cooke) P. Martin, J. S. African Bot. 35: 304. 1969.

Miller (1961) recognized that Cooke's fungus had more fusoid, narrower ascospores, 12-17 x 5-8 µm, than did *H. nummularium*, [i.e. *Biscogniauxia nummularia* (Bull.: Fr.) Kuntze], whose ascospores measure 11-15 x 6-9 µm. Because of the differences in ascospore characteristics and in geographical distribution: *H. nummularia* in Europe, *B. exutans* in B.C., western and southern USA and also reported from China, Bermuda, Philippines, it seems suitable to recognize the latter as a separate species in *Biscogniauxia*. Host plants include G: CA (Miller 1961); A: OR 1989; BC: MEB 8071). Also in British Columbia, the fungus has been collected on *Amelanchier* (MEB 7834), *Rhamnus purshiana* DC. (MEB 7430,7678, 7736), *Salix* (MEB 7771, 7920).

Hypoxylon vogesiacum (Pers.) Sacc. A: OR (1989).

LOCULOASCOMYCETES

Myriangiales, Elsinoaceae:
Elsinoe ledi (Peck) Zeller G: CA, OR, WA (1966, 1989).
Elsinoe mattirolianum G. Arnaud & Bitancourt A: CA (1989).

Schizothyriaceae:
Schizothyrium cfr. ***pomi*** (Mont. ex Fr.) v. Arx G: BC (MEB 7544). Ascomata on branches are mostly elongate and often branched rather than rounded. Asci and ascospores are in accord with other specimens of this species.

Capnodiales, Capnodiaceae:
Capnodium walteri Sacc. A: BC (1986). Hughes (1976) illustrated hyphae, ascoma, ascospore and pycnidial anamorph in *Phaeoxyphiella*.

Dothideales, Dothideaceae:
Mycosphaerella arbuticola (Peck) House A: CA, OR, WA, BC (1966, 1986, 1989, MEB 7631).
Mycosphaerella gaultheriae (Cooke & Ellis) House G: CA, OR, WA, BC (1966, 1986, 1989, MEB 7463, 7510).

Chaetothyriales, Herpotrichiellaceae:
Capronia minima (Ellis & Everh.) Barr A: BC (MEB 7668)
Capronia nigerrima (Bloxam) Barr A: BC (MEB 7900).

Patellariales, Patellariaceae:
Endotryblidium insculptum (Cooke) Petrak A: BC (MEB 7362, 7503, 7926). This relatively uncommon species develops in

branches of various woody plants and has large, 1-(3-) septate ascospores, 50-75 x 20 µm. Early stages in development of ascomata and ascospores are strongly suggestive of species in *Botryosphaeria*, but mature ascomata and ascospores are quite different.

Pleosporales, Hysteriaceae:
Gloniopsis praelonga (Schwein.) Zogg A: BC (MEB 7540, 7781, 7792, 7986, 7997, 8074, 8106, 8129, 8142, 8231).
Hysterium pulicare Pers. A: BC (MEB 7807).
Hysterographium flexuosum (Schwein.: Fr.) Sacc. [or as *H. vulvatum*] A: WA, BC (1966, 1989, MEB 7156, 7165, 7322, 7363, 7416, 7504, 7541, 7656, 7752, 7809, 7856, 7876, 7948, 8140). Common on old branches.
Hysterographium mori (Schwein.) Rehm A: BC (MEB 7164, 7241, 7279, 7553, 7628, 7696, 7872).

Venturiaceae:
Protoventuria gaultheriae (Ellis & Everh.) Barr G: BC (1986 as *Gibbera*, MEB 7462).

Botryosphaeriaceae:
Guignardia vaccinii Shear V: BC (MEB 7236, 7321, 7662, 7718, 8224).

Pleomassariaceae:

The suggestion by Aptroot (1991) that phragmo- and dictyosporous species assigned to *Splanchnonema* and *Pleomassaria* respectively are not truly separable, resulted in a cladistic study (Barr, in preparation) that indicates only one genus should be accepted for the species having asymmetric ascospores. For that reason, the two species below are described under the earlier name *Splanchnonema*. The related species in *Pleomassaria* mentioned in discussion are also to be transferred to *Splanchnonema* in a forthcoming article.

Splanchnonema arbuti Barr, sp. nov. Fig. 2g-i

Ascomata dispersa vel gregaria immersa globosa 500-700 µm diametro, apices rotundati, peridia cellularum pseudoparenchymatorum rubrobrunnea 25-50 µm lata vel 50-100 µm in parum superis. Asci bitunicati vel 250 x 18-22 µm cylindrici clavati. Pseudoparaphyses cellulosae. Ascosporae 30-42 x 14-18(-20) µm brunneae ellipsoideae vel fusoideae transversaliter 7-9(11-)septatae et longitudinaliter 2-3 septatae uniseriatae, tunica gelatinosa circumcinctae. Holotypus in ramis *Arbuti menziesii*, "British Columbia, Sidney, 1 Dec 1991" a M. E. Barr n. 7873 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata scattered to gregarious, immersed in periderm or erumpent superficial when periderm gone, nearly globose, 500-700 µm diam; apex rounded, becoming excavated, ostiole filled with pseudoparaphyses; peridium dark brown, small pseudoparenchymatous cells, 25-50 µm

wide, up to 50-100 µm wide in upper regions, inner layer pallid, compressed rows of cells, light brown hyphae into substrate. Asci up to 250 x 18-22 µm, cylindric. Pseudoparaphyses narrowly cellular, 2-3 µm wide. Ascospores 30-42 x 14-18(-20) µm, reddish brown to dark brown, ellipsoid fusoid, ends tapering and acute, 7-9-(11-) septate, two to three longitudinal septa in all but end cells, constricted at slightly submedian, first-formed septum; wall firm, foveolate at maturity, gel coating 2-4 µm wide; one or two globules per cell; uniseriate in the ascus.

In branches of *Arbutus menziesii*. Additional collections: British Columbia: Sidney, 7715, 7780, 7899, 7971, 8033.

Splanchnonema arbuti is most closely related to *Pleomassaria hesperia* Barr on *Populus* and *Salix*, whose ascospores are usually smaller and have a verruculose or smooth wall (Barr 1990c) rather than foveolate.

Splanchnonema vaccinii Barr, sp. nov. Fig. 2j-l

Ascomata dispersa vel gregaria immersa globosa sphaeroidea 250-450 µm lata 200-300 µm alta, apices obtusi rotundati vel brevi papillati, peridia brunnea cellularum pseudparenchymatorum circa 20 µm lata. Asci bitunicati 100-140 x 20-30 µm clavati. Pseudoparaphyses cellulosae. Ascosporae 36-48 x (12-)14-16 µm cinnamomeae obovoideae transversaliter 7-9-septatae et longitudinaliter 1-2-septatae biseriatae, tunica gelatinosa circumcinctae. Holotypus in ramulis *Vaccinii parvifolii*, "British Columbia, Sidney, 13 Jul 1990" a M. E. Barr n. 7212 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata separate or gregarious, immersed in thin twigs, globose sphaeroid, 250-450 µm wide, 200-300 µm high; apex rounded or short papillate, up to 90-100 µm wide and high; peridium brown, ca. 15-20 µm wide, few rows of pseudoparenchymatous, slightly compressed cells. Asci 100-140 x 20-30 µm, clavate. Pseudoparaphyses narrowly cellular, 2-3 µm wide. Ascospores 36-48 x (12-)14-16 µm, bright yellow brown, obovoid, ends narrowed but obtuse, 7-9-septate, one or two longitudinal septa through most cells, constricted at slightly submedian, first-formed septum; wall thickened, foveolate, gel coating 5-10 µm wide; granular or one or two globules per cell; overlapping biseriate in the ascus.

In thin twigs of *Vaccinium parvifolium* amd *V. membranaceum* Douglas. Additional collections: British Columbia: Sidney, 7239, 7318, 7594, 7663, 7933, 8165, 8223. USA: Oregon: Mt. Hood Co., Tilly Jane Rec. Area, Mt. Hood, 8 Aug 1992, MEB 8210.

The thin twigs seem an unlikely substrate for a species of the Pleomassariaceae, and the peridium of ascomata is unusually narrow for such taxa. *Splanchnonema vaccinii* is similar in many respects to *Pleomassaria holoschista* (Berk. & Broome) Sacc. which has larger ascomata and develops in branches of *Alnus* in Europe and

western Canada.

Dacampiaceae:

Chaetomastia littoralis Barr, sp. nov. Fig. 2d-f

Ascomata immersa vel erumpentia gregaria obpyriformia 300-600 µm lata, apices obtusi papillati, ostiola periphysata, peridia rubrobrunnea cellularum pseudoparenchymatorum 40-50 µm lata vel 100 µm in partum superis. Asci bitunicati 125-150 x 10-12 µm cylindrici. Pseudoparaphyses cellulosae. Ascosporae 16-23 x 8-10 µm brunneae ellipsoideae vel obovoideae 3-septatae foveolatae uniseriatae. Holotypus in ramis *Arbuti menziesii* "British Columbia, Sidney, 29 Apr 1991," a M. E. Barr n. 7536 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata immersed or partially erumpent from periderm, gregarious or thickly scattered, obpyriform, 300-600 µm wide; apices as blunt papillae projecting slightly, ostiole periphysate; peridium 40-50 µm wide, up to 100 µm at apex, externally reddish brown, small pseudoparenchymatous cells, mid layer in upper regions, light brown pseudoparenchymatous cells, internally pallid compressed rows of cells. Asci 125-150 x 10-12 µm, cylindric, 8-spored or 4-6 maturing. Pseudoparaphyses narrowly cellular, 1.5-2 µm wide. Ascospores 16-23 x 8-10 µm, clear brown to dark brown, ellipsoid or somewhat obovoid, ends obtuse, 3-septate, constricted deeply at median first-formed septum, occasionally separating into two partspores; wall foveolate; guttulate, then one globule per cell; uniseriate, partially overlapping in the ascus.

In dead branches of *Arbutus menziesii*. Additional collections: British Columbia: Sidney, 7323, 7390, 7554, 7739, 7791, 7808, 7893, 7952, 8225.

The ascospores of this species are similar to those of the arctic-alpine species *C. hirtula* (Karsten) Berlese and *C. sambuci* (Earle) Barr (Barr 1989a) but typically they are eight per ascus and the walls are foveolate rather than verruculose. The collections are from trees on the edge of Saanich Inlet or within one block of the water, thus the specific epithet.

Sinodidymella occidentalis Barr, sp. nov. Fig. 2a-c

Ascomata immersa gregaria sphaeroidea ca. 400 µm lata, 300 µm alta, apices obtusi irregulares, peridia brunneae cellularum pseudoparenchymatorum 40-50 µm lata vel 90 µm in partum superis. Asci bitunicati 100-120 x 9-10 µm cylindrici. Pseudoparaphyses cellulosae. Ascosporae 12-15 x 5-6 µm hyalinae ellipsoideae fusoideae uniseptatae uniseriatae. Holotypus in ramis *Arbuti menziesii*, "British Columbia, Sidney, 1 Dec 1990" a M. E. Barr n. 7392 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata immersed in old periderm, gregarious, sphaeroid, ca. 400 µm wide, 300 µm high; apex rounded, thickened and irregular around pore, not definitely

ridged; peridium 40-50 µm wide, up to 90 µm wide at apex, externally dark brown, small pseudoparenchymatous cells, mid region hyaline, 10-13 µm, internally compressed rows of hyaline cells. Asci 100-120 x 9-10 µm, cylindric. Pseudoparaphyses narrowly cellular. Ascospores 12-15 x 5-6 µm, hyaline, ellipsoid fusoid, 1-septate, constricted; wall smooth; one or two globules per cell; uniseriate in the ascus.

In branches of *Arbutus menziesii*. Additional collections: British Columbia: Sidney, 7481, 7923, 8119.

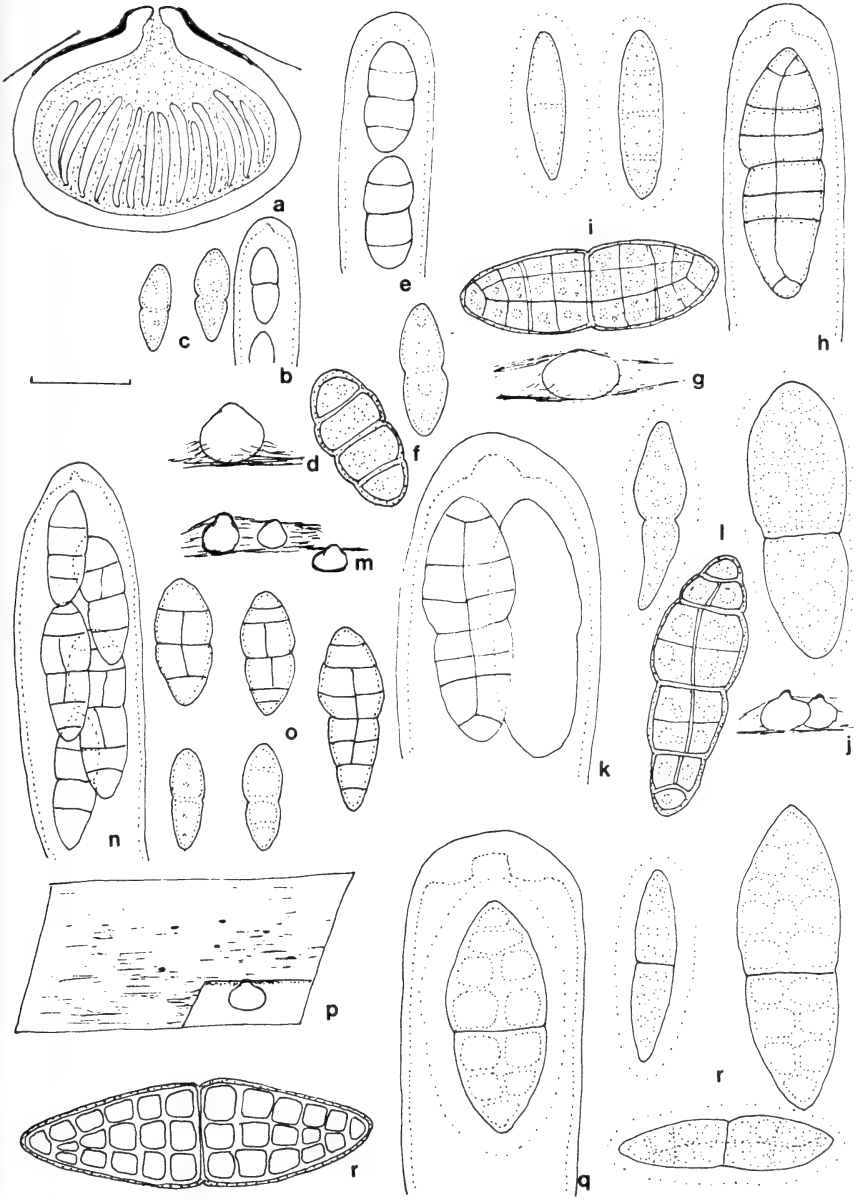
Sinodidymella was described for *S. verrucosa* (Petrak) Yue & O. Eriksson (Yue and Eriksson 1985), a Chinese species. In addition to the radiating ridges that surround the ostiole, the hyaline, one-septate ascospores in cylindric asci are distinctive characteristics of the genus. The apical ridges are not so conspicuous in *S. occidentalis* as in the type species, nor in other North American taxa to be described later, that have similar ascus and ascospore features. Yue and O. Eriksson did not assign the genus to a family, but peridium structure is typical of the Dacampiaceae.

Teichospora hesperia Barr, sp. nov. Fig. 2m-o

Ascomata immersa erumpentia gregaria globosa 450-600 µm diametro, apices obtusi rotundati vel compressi, ostiola periphysati, peridia rubrobrunnea cellularum pseudoparenchymatorum 60-100 µm lata. Asci bitunicati (75-)90-135 x (9-)10-18(-20) µm clavati vel cylindrici. Pseudoparaphyses cellulosae. Ascosporae (14-)18-22(-28) x (7-)8-10 µm brunneae pallidae ellipsoideae fusoideae transversaliter 3-5-7-septatae et longitudinaliter 1-septatae uniseriatae vel biseriatae. Holotypus in ramis *Arbuti menziesii*, "British Columbia, Sidney, 1 Dec 1991" a M. E. Barr n. 7874 lectus in Herb. DAOM et isotypus in NY depositus.

Ascomata immersed in or erumpent from wood and old periderm, gregarious, globose, 450-600 µm diam; blunt apical papilla short when erumpent, well developed when immersed and somewhat compressed at times, reddened at times, ostiole periphysate; peridium 60-100 µm wide, externally blackened and encrusted pseudoparenchymatous cells, mid layer surrounding locule or only formed near apex, reddish brown, internally pallid compressed rows of

Fig. 2. a-c. *Sinodidymella occidentalis*: a, outline of ascoma, b, ascus apex, c, ascospores. d-f. *Chaetomastia littoralis:* d, habit of ascoma, e, ascus apex, f, ascospores. g-i. *Splanchnonema arbuti*: g, outline of ascoma, h, ascus apex, i, ascospores. j-l. *Splanchnonema vaccinii*: j, outline of ascomata, k, ascus apex, l, ascospores. m-o. *Teichospora hesperia*: m, habit of ascomata, n, ascus apex, o, ascospores. p-r. *Decaisnella pachyspora:* p, habit of ascomata, q, ascus apex, r, ascospores. Standard line = 15 µm for asci and ascospores, 150 µm for ascoma. Habit sketches not to scale.


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
r

cells. Asci (75-)90-135 x (9-)10-18(-20) µm, clavate cylindric. Pseudoparaphyses numerous, narrowly cellular, 2-3 µm wide, occluded with guttules below ostiole at times. Ascospores (14-)18-22(-28) x (7-)8-10 µm, light brown, ellipsoid fusoid, tapered to obtuse ends, 3-5-7-septate, one longitudinal septum in mid cells, constricted at nearly median, first-formed septum; wall smooth; contents homogeneous; uniseriate or partially biseriate in the ascus.

In branches of *Arbutus menziesii*. Additional collections: British Columbia: Sidney, 7157, 7280, 7391, 7482, 7627, 7687, 7740, 7802, 7934, 7935, 7991, 7992, 7998, 8007, 8061, 8069, 8105, 8130.

This species is rather variable in aspect, depending on whether it is immersed in wood or in periderm, or erumpent in small groups from wood. When immersed in wood, the apical papilla is well developed and may be somewhat compressed laterally, although not by any means appearing lophiostomataceous. Ascomata in the periderm often have a thinner peridium and could be taken to belong in *Chaetoplea*; in fact the species was first determined as *C. crossata* (Ellis & Everh.) Barr. However, even in such collections the peridium is three layered, at least toward the apex. Ascospore shape and septation are consistent. These resemble most closely those of *T. juglandis* (Ellis & Everh.) Barr (Barr 1990c), but ascomata in *T. hesperia* are larger and asci are usually narrower.

Phaeosphaeriaceae:
Chaetoplea pusilla (Karsten & Malbranche) Barr A: BC (MEB 7281, 7763, 7952, 8232).
Kalmusia clivensis (Berk. & Broome) Barr G: BC (MEB 8082).
Kalmusia coniothyrium (Fuckel) Huhndorf [and reported as *Leptosphaeria* or *Diapleella*] G: OR, WA (1966, 1989).

Lophiostomataceae:
Cilioplea amplispora Barr A: BC (MEB 7412, 7539).
Herpotrichia macrotricha (Berk. & Broome) Sacc. G: BC (MEB 1586, 8178).
Lophiostoma fuckelii Sacc. A: BC (MEB 7953).
Lophiostoma scrophulariae Peck A: BC (MEB 7954).
Massarina corticola (Fuckel) L. Holm A, G, V: BC (MEB 7288, 7365, 7386, 7398, 7479, 7525, 7529, 7574, 7595, 7716, 7922, 7950).
Massarina eccentrica Barr A: BC (MEB 7896, 7927, 8073).
Massarina lignorum (Wehmeyer) Barr A, G: BC (MEB 7619, 8053).
Massarina microcarpa (Fuckel) Sacc. A, G, V: BC (MEB 7319, 7371, 7597, 7661, 7957, 8905, 8118).

Melanommatales, Melanommataceae:
Melanomma rhododendri Rehm [and reported as *Leptosphaeria gaultheriae* Dearness] G: OR, WA, BC (1966, 1889, MEB

7465, 7545, 7618, 7634, 7672, 8081, 8108).

Platystomataceae:
Platystomum compressum (Pers.: Fr.) Trev. A, G, V: BC (MEB 7388, 7413, 7505, 7596, 7629, 7714, 7782, 7877, 7925, 8013, 8034, 8054, 8063, 8072, 8117, 8143, 8233).
Platystomum obtectum Peck A: BC (MEB 7485, 7637, 7794, 7806, 7897, 7949).
Thyridaria macrostomoides (De Not.) Barr A: BC (MEB 7166, 7565).
Thyridaria turrita (Cooke & Peck) Barr V: BC (MEB 7214).

Didymosphaeriaceae:
Didymosphaeria futilis (Berk. & Broome) Rehm A: BC (MEB 7520, 7924, 8112).
Didymosphaeria oblitescens (Berk. & Broome) Fuckel A, G: BC (MEB 7801, 7839, 8141, 8174).

Massariaceae:
Decaisnella pachyspora (Sacc.) Barr (Fig. 2p-r). A: BC (MEB 7410, 7415, 7418, 7657, 7697, 7753, 8470, 8185). Originally known only from wood of *Abies* in Italy (Barr 1990a, a collection on *Quercus* from Switzerland (Rappaz personal communication) led to recognition that this species also occurs on *Arbutus* in British Columbia.

Mytilidionaceae:
Glyphium elatum (Grev.) Zogg A: BC (MEB 7366, 8169).

ACKNOWLEDGMENT

It is a pleasure to thank S. M. Huhndorf for reviewing this manuscript.

LITERATURE CITED

Aptroot, A. 1991. A monograph of the Pyrenulaceae (excluding *Anthracothecium* and *Pyrenula*) and the Requienellaceae, with notes on the Pleomassariaceae, the Trypetheliaceae and *Mycomicrothelia* (lichenized and non-lichenized ascomycetes). Bibliotheca Lichenologica 44: 1-178.

Barr, M. E. 1964. The genus *Pseudomassaria* in North America. Mycologia 56: 841-862.

-----. 1978. The Diaporthales in North America with emphasis on *Gnomonia* and its segregates. Mycol. Mem. 7: 1-232.

-----. 1987. Prodromus to Class Loculoascomycetes. Publ. by the author, Amherst, MA. 168 p.

-----. 1989a. The genus *Chaetomastia* (Dacampiaceae) in North America. Mycotaxon 34: 507-515.

-----. 1989b. *Clypeosphaeria* and the Clypeosphaeriaceae. Syst. Ascomyc. 8: 1-8.

-----. 1990a. Melanommatales (Loculoascomycetes). N.

Amer. Fl. ser. II, 13: 1-129.
-----. 1990b. Prodromus to nonlichenized, pyrenomycetous members of Class Hymenoascomycetes. Mycotaxon 39: 43-184.
-----. 1990c. Some dictyosporous genera and species of Pleosporales in North America. Mem. New York Bot. Gard. 62: 1-92.
Eglitis, M., C. J. Gould, and F. Johnson. 1966. Fungi found on Ericaceae in the Pacific coastal area. Washington Agric. Exp. Sta. Bull. 675: 1-21.
Farr, D. F., G. F. Bills, G. P. Chamuris, and A. Y. Rossman. 1989. Fungi on plants and plant products in the United States. APS Press, St. Paul, MN. 1252 p.
Francis, S. M. 1975. *Anthostomella* Sacc. (Part I). Mycol. Pap. 139: 1-97.
Ginns, J. H. 1986. Compendium of plant diseases and decay fungi in Canada 1960-1980. Res. Branch Agric. Canada Pub'n 1813: 1-416.
Hansford, C. G. 1961. The Meliolineae. A monograph. Sydowia Beih. 2: 1-806.
Hilber, O., R. Hilber, and O. K. Miller Jr. 1987. Fungi of the Appalachian Mountains. Mycotaxon 30: 269-288.
Hughes, S. J. 1976. Sooty moulds. Mycologia 68: 693-820.
Miller, J. H. 1961. A monograph of the world species of *Hypoxylon*. Univ. Georgia Press, Athens, Ga. 158 p.
Parmelee, J. A. 1977. The fungi of Ontario. II. Erysiphaceae (mildews). Canad. J. Bot. 55: 1940-1983.
Theissen, F., and H. Sydow. 1915. Die Dothideales. Ann. Mycol. 13: 149-746.
Wehmeyer, L. E. 1933. The genus *Diaporthe* Nitschke and its segregates. Univ. Michigan Stud. Sci. Ser. 9: 1-349.
-----. 1941. A revision of *Melanconis, Pseudovalsa, Prosthecium,* and *Titania*. Univ. Michigan Press, Ann Arbor, MI. 161 p.
Yue, Jing-zhu, and O. Eriksson. 1985. Studies on Chinese ascomycetes. 2. *Sinodidymella verrucosa*. Mycotaxon 24: 293-300.

MYCOTAXON

Volume XLVI, pp. 403-405 January-March 1993

COOKEINA SULCIPES - AN ADDENDUM

Richard T. Hanlin

Department of Plant Pathology
University of Georgia
Athens, Georgia 30602-7274 USA

In a recent article describing a collection of *Cookeina sulcipes* (Berk.) Kuntze from Venezuela (Hanlin *et al.*, 1991) it was observed that the ascospores germinate by producing several short germ tubes that form small, globose microconidia at their tips. The statement was made that this phenomenon had not been reported previously in this species. This method of ascospore germination in *C. sulcipes* was, in fact, described and illustrated by Boedijn (1929) from material collected in Sumatra over 60 years ago. Boedijn (1933) also described the same type of ascospore germination in *C. tricholoma* (Mont.) Kuntze. Later, Paden (1975) illustrated this mode of germination in *C. sulcipes* with photographs of material collected in Costa Rica and Mexico. Unfortunately, these references were overlooked during the initial literature search.

Besides *Cookeina*, the formation of blastoconidia on short, sympodially proliferating germ tubes (conidigenous cells) produced on ascospores has been reported in several other species of the Sarcoscyphaceae, including *Nanoscypha tetraspora* (Seaver) Denison (Pfister, 1973), *Phillipsia domingensis* (Berk.) Berk. (Paden 1974), *P. rugospora* Paden (Paden, 1977), *Sarcoscypha austriaca* (Berk. ex Sacc.) Boud. (Harrington, 1990), *S. coccinea* (Fr.) Lambotte (Alexopoulos and Butler, 1949), *S. coccinea* var. *jurana* Boud. (Rosinski, 1953), and *S. occidentalis* (Schwein.) Sacc. (Harrington, 1990). In addition, in *C. sulcipes* (Boedijn, 1933) and in both *S. austriaca* and *S. occidentalis* (Harrington 1990) the ascospores may form conidia while still inside the ascus. Spores that form blastospores on the ascospores may also exhibit germination by means of germ tubes that elongate into hyphae, but both types of germination seem not to occur on the same ascospore.

Paden (1975) obtained mycelium of *C. sulcipes* and *Phillipsia crispata* (Berk. & M. A. Curtis) Le Gal in culture and reported that both species produced chains of arthroconidia. In both species the arthroconidia germinated readily and formed hyphae. Paden also observed that the blastospores formed on ascospores of *C. sulcipes* germinated when fresh.

Paden (1984) erected the genus *Molliardiomyces* to accommodate anamorphs of *Nanoscypha, Phillipsia, Pithya* and *Sarcoscypha*. *Molliardiomyces* was characterized by the formation of blastospores on the tips of conidiogenous cells that proliferate sympodially and that arise from hyaline mycelium. The conidia are 1-celled, hyaline or yellowish, subglobose to oblong or obovate, and they accumulate in mucilaginous masses. Paden (1986) later emended the description of *Molliardiomyces* to include species with percurrent proliferation of the conidiogenous cells, a characteristic he found in the anamorph of *Phillipsia crispata*. He also stated that the earlier reports of arthroconidium formation in *P. crispata* and *C. sulcipes* were probably erroneous and based on contaminated cultures. Harrington (1990) has described additional *Molliardiomyces* anamorphs for *S. coccinea* and *S. dudleyi* (Peck) Baral.

The role of these spores in the life cycles of the various species is unclear. Other than *Cookeina*, none of the conidia reported from other genera have been observed to germinate.

ACKNOWLEDGEMENTS

I thank R. P. Korf for calling Boedijn's papers to my attention and for reviewing this note.

LITERATURE CITED

Alexopoulos, C. J., and E. E. Butler. 1949. Conidia-like structures in *Plectania coccinea*. *Mycologia* 41:180-182.

Boedijn, K. B. 1929. Beitrag zur Kenntnis der Pilzflora von Sumatra. *Rec. Trav. Bot. Neerl.* 26:396-439.

Boedijn, K. B. 1933. The genera *Phillipsia* and *Cookeina* in Netherlands India. *Bull. Jard. Bot. Buitzen*. 3:57-76.

Hanlin, R. T., C.-Y. Chien, and O. Tortolero. 1991. Icones Ascomycetum Venezuelae: *Cookeina sulcipes*. *Trans. Mycol. Soc. R.O.C.* 6:45-53.

Harrington, F. A. 1990. *Sarcocypha* in North America (Pezizales, Sarcoscyphaceae). *Mycotaxon* 38:417-458.

Paden, J. W. 1974. Ascospore germination in *Phillipsia domingensis* and *P. lutea*. *Mycologia* 66:25-31.

Paden, J. W. 1975. Ascospore germination, growth in culture, and imperfect spore formation in *Cookeina sulcipes* and *Phillipsia crispata*. *Canad. J. Bot.* 53:56-61.

Paden, J. W. 1977. Two new species of *Phillipsia* from Central America. *Canad. J. Bot.* 55:2685-2692.

Paden, J. W. 1984. A new genus of Hyphomycetes with teleomorphs in the Sarcoscyphaceae (Pezizales, Sarcoscyphineae). *Canad. J. Bot.* 62:211-218.

Paden, J. W. 1986. On the anamorph of *Phillipsia crispata*. *Mycotaxon* 25:165-174.

Pfister, D. H. 1973. Notes on Caribbean Discomycetes. III. Ascospore germination and growth in culture of *Nanoscypha tetraspora* (Pezizales, Sarcoscyphineae). *Mycologia* 65:952-956.

Rosinski, M. A. 1953. Two types of spore germination in *Sarcoscypha coccinea* (Scop. ex Fr.) Lambotte. *Mycologia* 45:302-306.

MYCOTAXON

Volume XLVI, pp. 407-424 January-March 1993

SPANISH MYXOMYCETES. VII. (PROVINCE OF CASTELLON)

G. Moreno, C. Illana & A. Burguete

Departamento de Biología Vegetal (Botánica). Universidad de Alcalá de Henares. 28871 Madrid. Spain.

ABSTRACT

63 taxa of *Myxomycetes* from the province of Castellón are recorded, of which 54 are new provincial records, and five: *Craterium obovatum* Peck, *Cribraria minutissima* Schwein., *Diderma cingulatum* Nann.-Brem. *Diderma umbilicatum* var. *macrospora* Meylan and *Physarum viride* var. *incanum* Lister, are new for Spain. We propose the new combination *Craterium obovatum* var. *dictyosporum* (Rostaf.) Moreno & Illana. From these five and from the less well known species we have added comments and photographs made under optical and SEM, the latter with the tecnique of critical point.

Key words: *Myxomycetes*, Spain, taxonomy, chorology.

INTRODUCTION

Several studies on the *Myxomycetes* have been made previously in Southeastern Spain, especially in the provinces of Albacete and Murcia (GRACIA, 1981; GRACIA & al. 1981, 1982; LOPEZ-SANCHEZ, 1985; LOPEZ-SANCHEZ & al. 1986a, 1986b).

The present contribution completes the mycological study of this zone in which works have been scarce, and only 10 taxa have been reported (GRACIA, 1981; MORENO & al. 1989; ILLANA, 1989). To these records we now add the more recently collected *Comatricha anomala* Rammeloo and *Comatricha pellucida* Moreno & Illana, the latter was newly described and illustrated (MORENO & al., in press).

We give the complete reference for those taxa which are new for the spanish catalogue of *Myxomycetes*. The material studied is kept in the herbarium of the University of Alcalá de Henares (AH). The major part of the material has been collected by A. Burguete.

FLORISTIC CATALOGUE IN ALPHABETICAL ORDER

Arcyria cinerea (Bull.) Pers.

On unidentified wood, Fuente la Reina, 27.X.1990, AH 12852. On unidentified wood, Castellón (capital), 25.I.1990, AH 13776.

Arcyria denudata (L.) Wettst.

On dead cladodes of *Opuntia ficus-indica*, Almazora, 24.I.1990, AH 12551 and 12860.

Arcyria leiocarpa (Cooke) G. W. Martin & Alexop.
≡ *Hemitrichia leiocarpa* (Cooke) Lister **(Figs. 1-4)**

On woody remains, Fuente la Reina, 31.I.1990, AH 14279.

Our collection consists of a dozen stalked sporocarps, looking like those of *Arcyria cinerea* (Bull.) Pers., but with laxer more elastically expanding capillitium, stalked, subglobose, ochraceous and with a big calyculus. The microscopic characters of *A. leiocarpa* are very typical, with a capillitium wich is ramified, anastomosed and ornamented with 2-3 very faint spirals which can even disappear, also, with some irregularly distributed warts on its surface. The spores under the microscope are pale yellow, warted, 8-9 µm diam., under the SEM they show coralloid piles.

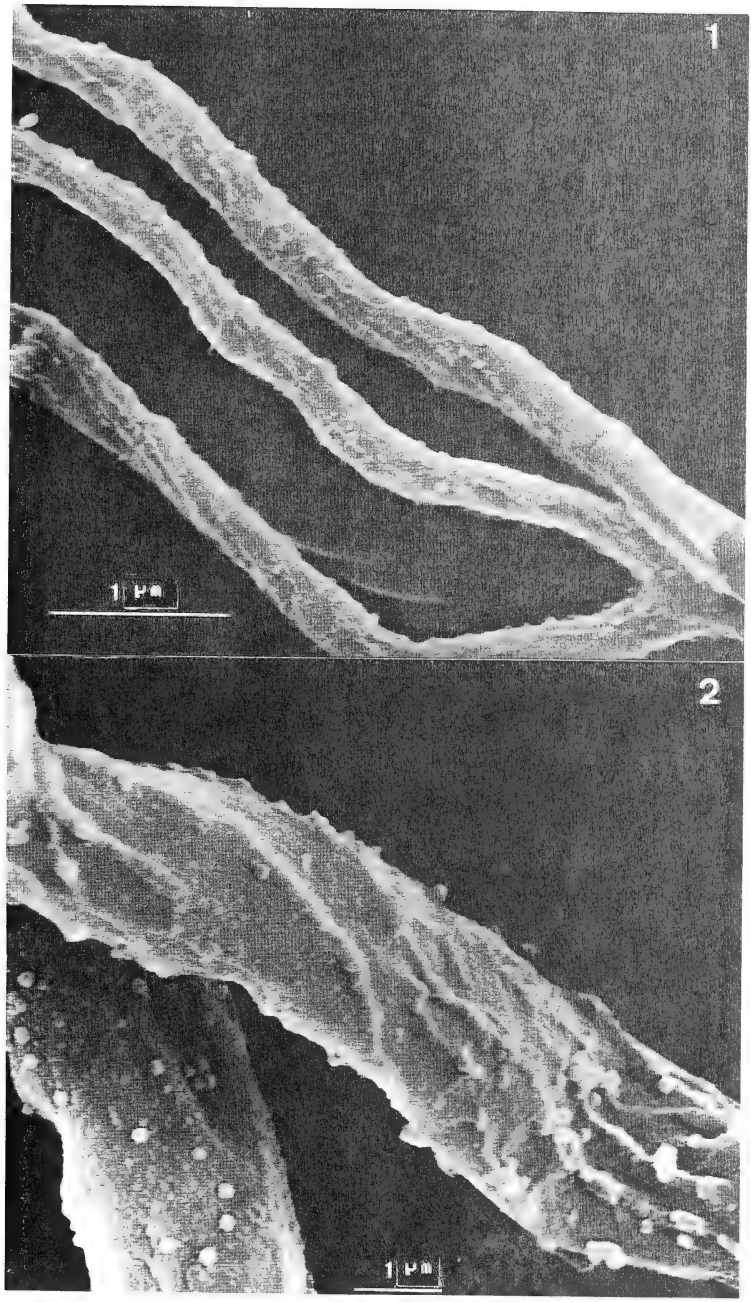
MARTIN & ALEXOPOULOS (1969), consider that, except for the spiral bands of the capillitium, it is a typical *Arcyria*. NANNENGA-BREMEKAMP (1982) agrees because its capillitium is not birefringent. Although we are using the name *A. leiocarpa* we think that the microscopic characters are not those of the genus *Arcyria* because of the presence of spirals on the capillitium and its different sporal ornamentation; therefore the taxonomic status of this species should be considered again.

In Spain it has been recorded from Galicia by CABO (1988, 1989). It has not been possible to study this material - because the herbarium is not available-, and therefore we could not confirm its identification.

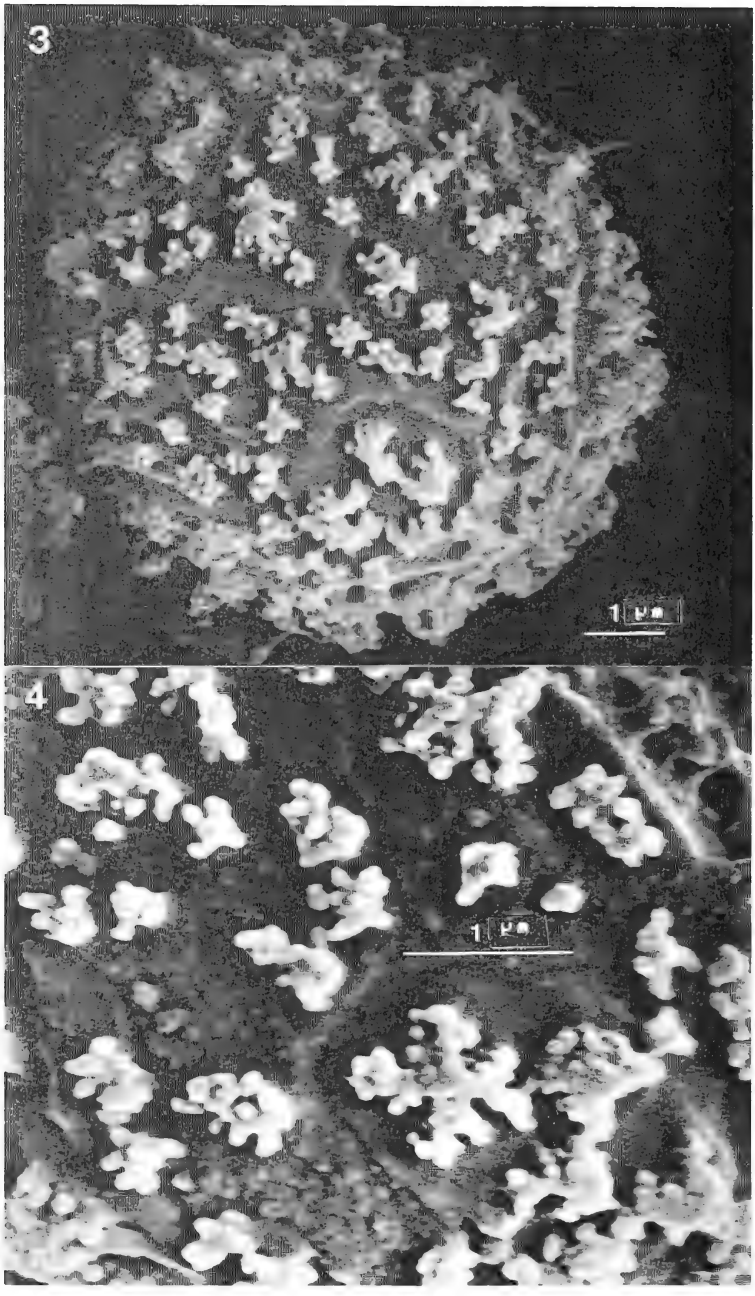
Both *Arcyria stipata* (Schwein.) Lister and *A. abietina* (Wigand.) Nann.-Brem - = *Hemitrichia abietina* (Wigand) G. Lister -, also have spirals on the capillitium. The former has a reddish capillitium and the latter posseses yellowish sporocarps and reticulate spores.

Arcyria minuta Buchet
= *Arcyria gulielmae* Nann.-Brem.
= *Arcyria carnea* (G. Lister) G. Lister

On wood of *Pinus pinaster*, Fuente la Reina, 12.X.1990, AH 12651.



Figs. 1-2: *Arcyria leiocarpa*, capillitium.



Figs. 3-4: *Arcyria leiocarpa*, spore and detail of the ornamentation.

Arcyria obvelata (Oeder) Onsberg

On wood of *Pinus pinaster*, Fuente la Reina, 12.X.1990, AH 12652.

Arcyria pomiformis (Leers) Rostaf.

On unidentified wood, Mas de Luis, 23.II.1990, AH 12527. Idem, Benicasim, 23.X.1990, AH 12851.

Badhamia foliicola Lister

On a dead leaf of *Quercus* sp., Artana, 20.X.1990, AH 13131. Idem, on wood of *Olea europaea*, AH 13132. On wood of *Populus* sp., Fuente la Reina, 12.X.1990, AH 12642. On a living stem of *Genista scorpius*, Fuente la Reina, 27.X.1990, AH 13127.

Badhamia gracilis (T. Macbride) T. Macbride

On dead cladodes of *Opuntia ficus-indica*, Almenara, 28.X.1990, AH 13103.

Badhamia macrocarpa (Ces.) Rostaf.

On a dead stem of *Genista scorpius*, Fuente la Reina, 12.X.1990, AH 12656 and 12657.

Badhamia panicea (Fr.) Rostaf.

On wood of *Populus* sp., Almazora, 23.I.1990, AH 12548 and 12549.

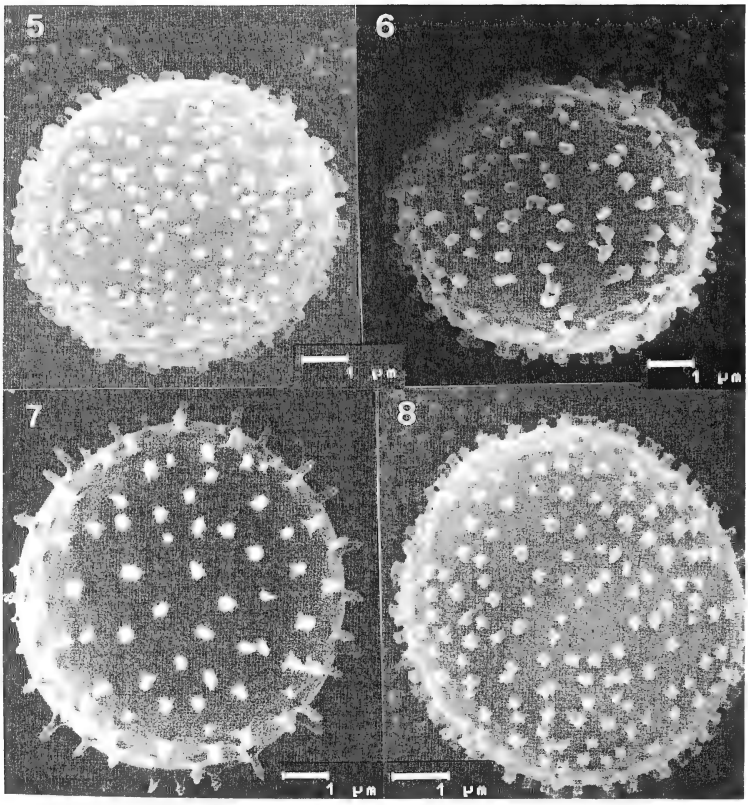
Ceratiomyxa fruticulosa (Müller) T. Macbride

On wood of *Pinus halepensis*, Villamalur, 13.XI.1990, AH 12717.

Comatricha lurida Lister **(Figs. 5-6)**
= *Collaria lurida* (Lister) Nann.-Brem.

On dead leaves of deciduous trees, Fuente la Reina, 11.II.1990, AH 12526. Idem, on stems of herbaceous plants, AH 12882. Idem, on wood, 31.I.1990, AH 12968. Idem, on a leaf of *Quercus ilex* ssp. *ballota*, 12.X.1990, AH 12648.

The sporal ornamentation under the SEM shows long and very dense bacula, which agrees with RAMMELOO's findings (1983).



Figs. 5-8: 5 and 6. *Comatricha lurida*, spore; 7. *Comatricha pulchella*, spore; 8. *Comatricha tenerrima*, spore.

Comatricha nigra (Pers. ex J.F. Gmelin) Schröter

On wood of *Pinus* sp., Puebla de Tortosa, 26.X.1990, AH 13488. On wood of *Pinus* sp., Retaule, 27.I.1990, AH 12083 and 12865. On wood of *Pinus* sp., Fuente la Reina, 31.I.1990, AH 12561.

Comatricha pulchella (Babington) Rostaf. **(Fig. 7)**

On unidentified wood, Retaule, AH 12864. On unidentified wood, Fuente la Reina, 31.I.1990, AH 12929. Idem, on cones of *Pinus pinaster*, AH 12884.

The spores under the SEM show an ornamentation formed by rather widely spaced long baculae and with denticulate apices.

Comatricha tenerrima (M.A. Curtis) G. Lister **(Fig. 8)**

On herbaceous plant remains, Castellón, 24.I.1990, AH 12562. On wood, Castellón, 22.I.1990, AH 12863.

The spores under the SEM show an ornamentation of short and packed baculae, with stellate apices.

Craterium leucocephalum (Pers. ex J.F. Gmelin) Ditmar

On dead leaves of a deciduous trees, Villarreal de los Infantes, 6.II.1990, AH 12721. On leaves and branches of *Quercus ilex* ssp. *ballota*, Fuente la Reina, 27.X.1990, AH 12641 and 12714.

Craterium minutum (Leers) Fr.

On dead herbaceous stems of *Foeniculum vulgare*, Retaule, 27.I.1990, AH 12521. Idem, on wood and dead leaves of *Salix* sp., AH 12520. Idem, on herbaceous remains and dead leaf of a deciduous tree, AH 12519. On dead branches of *Quercus* sp., Fuente la Reina, 27.X.1990, AH 13530.

Craterium obovatum Peck, Bull. Buffalo Soc. Nat. Sci. 1: 64. 1873 **(Fig. 9)**

≡ *Badhamia obovata* (Peck) S.J. Smith in G.W. Martin, Brittonia 13: 112. 1961

= *Badhamia rubiginosa* (Chev.) Rostaf., Sluzowce Monogr. Suppl. 5. 1876

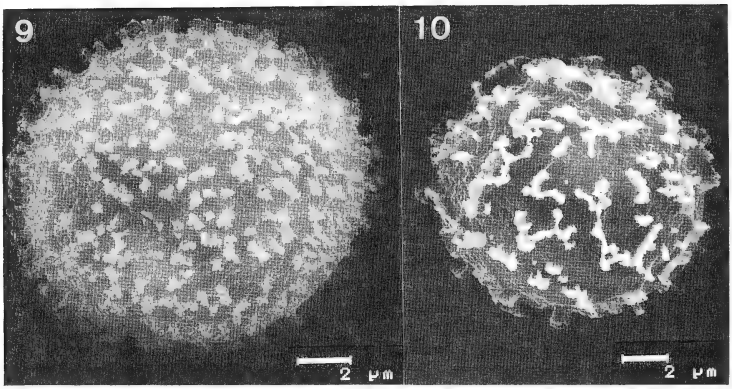
On dead leaves of *Quercus* sp., Artana, 20.X.1990, AH 13099.

We are following the taxonomic treatment of FARR (1974, 1976) who considers that this species belongs to the genus *Craterium* because of the sporocarp form, the peridium structure - remaining as a cup - and the presence of a columella.

The three original varieties of *Craterium obovatum*: "var. *obovatum*", "var. *dictyosporum*" and "var. *globosum*" are different, especially, because of the sporal ornamentation. The spores of the "var. *obovatum*" are formed by strong isolated spines, which in the "var. *dictyosporum*" tend to coalesce forming an incomplete reticulation. The "var. *globosum*", besides having spores with a complete reticulum has globose sporocysts, peridium with pinkish calcareous scales and an almost black stipe with a structure on its base like a net (NANNENGA-BREMEKAMP, 1974). MARTIN & ALEXOPOULOS (1969) do not accept the above mentioned varieties.

ING (1982) considered that "var. *globosum*" has enough characters to be an independent species. Since there already exists another species called *Craterium globosum*, he renamed it *Craterium muscorum* Ing.

We do not know any record of *Craterium obovatum* var. *obovatum* in Spain.



Figs. 9-10: ***Craterium obovatum***; 9. ***Craterium obovatum*** **var.** ***obovatum***, spore; 10. ***Craterium obovatum*** **var.** ***dictyosporum***, spore.

Craterium obovatum **var.** ***dictyosporum*** (Rostaf.) Moreno & Illana *comb. nov.* **(Fig. 10)**

≡ *Badhamia dictyospora* Rostaf., Sluzowce Monogr. Suppl.: 4. 1876.

≡ *Badhamia rubiginosa* var. *dictyospora* (Rostaf.) Lister, Monogr. Mycetozoa 35. 1894

On wood of *Quercus* sp., Fuente la Reina, 27.X.1990, AH 13098. On wood of *Quercus* sp., Villamalur, 2.II.1990, AH 12716.

It has been recorded, recently, in Spain from the provinces of Badajoz and Cáceres by MORENO & al. (1991) and from Jaén by LADO (1992).

Cribraria cancellata **var.** ***fusca*** (Lister) Nann.-Brem.

On wood of *Pinus pinaster*, Fuente la Reina, 12.X.1990, AH 12653. Idem, 25.X.1990, AH 12704. On wood of *Pinus* sp., Artana, 20.X.1990, AH 13585.

Cribraria microcarpa (Schrader) Pers.

On wood of *Pinus* sp., Artana, 20.X.1990, AH 12176.

Cribraria minutissima Schwein., Trans. Am. Phil. Soc. II. 4: 260. 1832 **(Figs. 11-13)**

On wood of *Pinus* sp., Villamalur, 13.XII.1990, AH 13466.

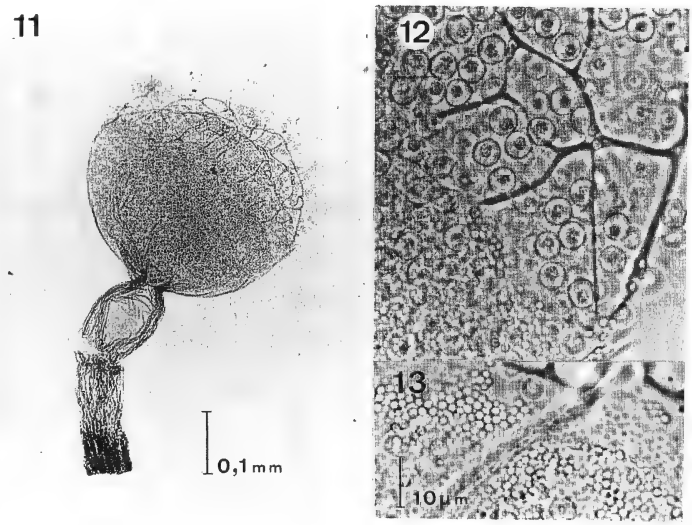
Cribraria minutissima, is characterized by its small, straight brown-reddish sporocarps, which are approximately 1 mm high. The peridium is formed by a well-defined and deep cup with a thickened margin, and with filaments wich

form a net with large meshes. There are abundant dictidine granules on the calyculus but they are absent on the peridial net. The spores are pale yellow, warted, 7-8 µm diam.

MARTIN & ALEXOPOULOS (1969) and FARR (1976) describe this species with or without a calyculus. NANNENGA-BREMEKAMP & YAMAMOTO (1983) after having examined a large number of collections, do not observe any transition in the characters of the calyculus and accept on the one hand *C. minutissima* as having a deep cup with a thickened (constricted) margin, and on the other they separate the forms lacking a cup as *C. confusa* Nann.-Brem. & Y. Yamam., with a rather lax net and a form (possibly an unnamed variety or species) with a small meshed net. FARR (1985) contributes with data on the world chorology of the latter species.

KELLER & al. (1988) studied, with SEM, the types of both species from several places; they give new data to differentiate both taxa and indicate that they occur frequently on the bark of *Juniperus*, *Thuja* and *Vitis*, in moist chambers, even intermingled. After having examined more than 100 collections, they agree with the opinion of Nannenga-Bremekamp and Yamamoto as they too do not find any evidence which can prove a transition between specimens having and lacking a cup.

GRACIA (1981) has cited *C. minutissima* from Barcelona, but after examining the collection it has been identified as *C. confusa* by NANNENGA-BREMEKAMP & YAMAMOTO (op. cit.) and later published as such by GIRBAL (1986). Therefore our record of *C. minutissima* is the first one for Spain.



Figs. 11-13: ***Cribraria minutissima***, sporocarp, spores, peridial net and caliculus.

Cribraria violacea Rex

On wood of *Olea europaea*, Artana, 20.X.1990, AH 13494.

Dictydiaethalium plumbeum (Schumacher) Rostaf. ex Lister

On dead stems of *Foeniculum vulgare*, 23.I.1990, AH 12555. Idem, 25.X.1990, AH 12689.

Diachea leucopodia (Bull.) Rostaf.

On dead leaves of deciduous trees and a dead stem of *Apiaceae*, Villareal de los Infantes, 6.II.1990, AH 12522 and 12705.

Diderma cingulatum Nann.-Brem., *em.* Buyck, Bull. Jard. Bot. Nat. Bel. 58: 185-193. 1988 **(Figs. 14-17)**
= *Diderma rimosa* Eliass. & Nann.-Brem., Proc. Kon. Ned. Akad. Wetensch., Ser. C. 86: 148. 1983

On branches of *Populus* sp., Mas de Luis, 23.II.1990, AH 13164.

Our collection is characterized by its numerous, strongly aggregate and compressed sporocarps which are sessile and globose. Its hypothallus is white and common to the colony. Its peridium is double with both layers well-separated, the outer being white and smooth and the inner grey, it dehisces irregularly. Its columella is extended, white, thin, often forked, and latterally applanate. Its capillitium is very abundant, elastically, protruding through the opening of the peridial layers, it is undulate, thick, dark, dichotomously and irregularly ramified, with axillary crossbars transversal membranous anastomoses. Its spores are warted, pale brown-violaceous, spherical to subglobose, with a pale equatorial band, 10-12 µm diam.

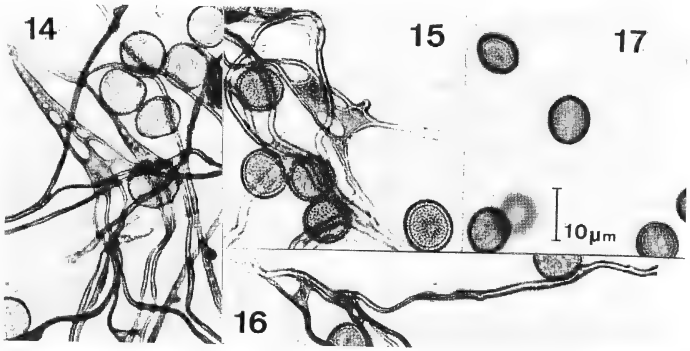
After the revision of the genus *Diderma* by BUYCK (1982, 1988), it seems to be a widely distributed species. It can be confused with other species of the so-called "*D. spumarioides-globosum*" complex, but its typical microscopical features separate it from other species. Our spore measurements are lower than those of the original description of *D. cingulatum* viz. 12-14 µm diam., confirming the colour and dimension variability of the spores (BUYCK, 1988).

Macroscopically *D. cingulatum em.* Buyck is very similar to *D. spumarioides* (Fr.) Fr. (i.e. those forms which have a subglobose columella), and it is necessary to use the microscopic characters to separate both species, but then the axillary crossbars of the capillitium and sporal morphology of *D. cingulatum* are good diagnostic features.

BUYCK (1988) indicates that *D. rimosa* Eliass. & Nann.-Brem. and *D. cingulatum* are synonymous because, according to him, the first one could be an anomalous form with

reticulate peridium, which has fructified in a very hot and moist atmosphere.

D. cingulatum has not been recorded previously from Spain.



Figs. 14-17: ***Diderma cingulatum***, capillitium and spores.

Diderma spumarioides (Fr.) Fr.

On dead leaves of *Quercus* sp., Fuente la Reina, 1.II.1990, AH 12862.

Diderma umbilicatum Pers.

On cones of *Pinus* sp., Villamalur, 2.II.1990, AH 12573. Idem, on wood of *Pinus* sp., AH 12576. On unidentified wood, Mas de Luis, 27.II.1990, AH 12574. On unidentified wood, Retaule, 27.I.1990, AH 12575.

Diderma umbilicatum **var.** ***macrospora*** Meylan, Bull. Soc. Vaud. Sc. Nat. 56: 67. 1926

On herbaceous plant remains and leaves of a deciduous trees, 3.II.1990, AH 12572.

The "var. *macrospora*" Meylan, differs from the type in its bigger spores, which in our specimens are 13-14 µm diam. According to KOWALSKI (1975) they are 14-15 µm. NANNENGA-BREMEKAMP (1974) indicates (13)14-15(16) µm for "var. *macrospora*" and 9-12 µm diam. for *D. umbilicatum* var. *umbilicatum*.

The "var. *umbilicatum*" has been found frequently in Spain, but this is the first record of "var. *macrospora*".

Didymium bahiense Gottsberger

On wood of *Pinus* sp., Castellón, AH 12535. On herbaceous plant remains, Borriol, 20.X.1990, AH 12712. On dead leaves of *Quercus* sp., Fuente la Reina, 27.X.1990, AH 13397.

Didymium difforme (Pers.) Gray

On woody remains, Sta. Magdalena, 26.I.1990, AH 12711. Idem, on herbaceous plant remains, AH 12718. On herbaceous plant remains, Borriol, 20.X.1990, AH 12712.

Didymium eximium Peck

On dead leaves, Artana, 22.I.1990, AH 13405. On herbaceous plant and leaf remains, Benicasim, 5.II.1990, AH 13395. On dead leaves of *Quercus*, Fuente la Reina, 27.X.1990, AH 13393 and 13406. On a dead leaf of *Smilax aspera*, Artana, 20.X.1990, AH 13407. Idem, on a dead leaf of *Quercus* sp., AH 13408.

Didymium marineri Moreno, Heykoop & Illana

On a living stem of *Phoenix canariensis*, Oropesa del Mar, 28.XII.1985, leg.: G. Moreno, AH 12566 and 13401. Idem, 18.V.1987, AH 12599.

Our collections are new records of this recently described species and up to date only found in Castellón on living stems and dead leaves of *Phoenix canariensis* (MORENO & al. 1990).

Didymium melanospermum (Pers.) T. Macbride

On herbaceous plant remains, Las Palmas, 23.I.1990, AH 12530. On a leaf of a deciduous tree, Villareal de los Infantes, 6.II.1990, AH 12563. On a dead leaf of *Quercus ilex* ssp. *ballota*, Fuente la Reina, 27.X.1990, AH 13369. On a stump of *Pinus* sp., Villamalur, 13.XI.1990, AH 13402.

Didymium minus (Lister) Morgan

On an unidentified leaf, Artana, 24.I.1990, AH 12564. On remains of a *Crassulaceae* and dead leaves, Las Palmas, 23.I.1990, AH 13394.

Didymium squamulosum (Alb. & Schwein.) Fr.

On dead leaves of *Ulmus* sp., Castellón, 1.II.1990, AH 12523 and 12524. On dead leaves of *Quercus* sp., Fuente la Reina, 27.X.1990, AH 13290.

Didymium vaccinum (Durieu & Mont.) Buchet

On remains of *Opuntia ficus-indica*, Castellón (capital), 24.I.1990, AH 12706. On remains of *Crassulaceae*, Castellón (capital), 28.I.1990, AH 12707.

Enteridium lycoperdon (Bull.) Farr

On a dead stem of *Pinus halepensis*, Oropesa del Mar, 1.VIII.1984, leg.: G. Moreno, AH 12571.

Fuligo septica (L.) Wigg.

On a stump of a deciduous tree dragged by sea, Oropesa del Mar, 9.VIII.1984, leg.: G. Moreno, AH 12567 and 12570. On a living stem of *Phoenix canariensis*, Oropesa del Mar, 26.VII.1984, leg.: G. Moreno, AH 12568.

Hemitrichia clavata (Pers.) Rostaf.

On wood of a deciduous tree, 3.X.1990, AH 12525.

Lamproderma scintillans (Berk. & Broome) Morgan

On a leaf of a deciduous tree, Castellón (capital), 25.I.1990, AH 12534. On a leaf of *Quercus pyrenaica*, Fuente la Reina, 1.II.1990, AH 13747. On an unidentified leaf, Villarreal de los Infantes, 6.II.1990, AH 12536.

Leocarpus fragilis (Dickson) Rostaf.

On a dead stem of *Pinus sylvestris*, Chodos, 13.IV.1990, AH 12309. On herbaceous dead stems, Fuente la Reina, 1.II.1990, AH 12560.

Metatrichia vesparium (Batsch) Nann.-Brem. ex G.W. Martin

On wood of a deciduous tree, Artana, 24.I.1990, AH 12554.

Perichaena depressa Lib.

On dead cladodes of *Opuntia ficus-indica*, Almazora, 23.I.1990, AH 12541. On wood of an unidentified deciduous tree, 27.I.1990, AH 12538 and 12539.

Physarum bitectum G. Lister

On remains of branches, Mas de Luis, 23.II.1990, AH 12681. On dead leaves of *Quercus* sp., Fuente la Reina, 1.II.1990, AH 12547.

Physarum bivalve Pers.

On remains of herbaceous plants and leaves, Mas de Luis, 23.I.1990, AH 12546. On a leaf of *Populus* sp., Fuente la Reina, 12.X.1990, AH 12654. On herbaceous plant remains, Villarreal de los Infantes, 6.II.1990, AH 12545.

Physarum cinereum (Batsch) Pers.

On a dead leaf of a deciduous tree, Villareal de los Infantes, 6.II.1990, AH 12543. On remains of herbaceous plants and a dead leaf of *Quercus ilex* ssp. *ballota*, Fuente la Reina, 1.X.1990, AH 12643. On a dead leaf of *Quercus* sp., Artana, AH 14207.

Physarum compressum Alb. & Schwein.

On remains of herbaceous plants, Borriol, 20.X.1990, AH 12712. On dead cladodes *Opuntia ficus-indica*, Castellón (capital), 24.I.1990, AH 12702. On remains of cupules and fruits of almond tree, Borriol, 30.X.1990, AH 13538. On a unidentified wood, Castellón, 18.X.1990, AH 13536. On living stem of *Phoenix canariensis*, Oropesa del Mar, 28.XII.1985, leg.: G. Moreno, AH 13404. Idem, Almazora, 23.I.1990, AH 12709.

Physarum decipiens M.A. Curtis
= *Physarum auriscalpium* Cooke

On bark of *Olea europaea*, Villamalur, 13.XI.1990, AH 12330.

Although our collection fits *Physarum auriscalpium* because of the ochraceous-orange colour of the peridium, we prefer to follow FARR (1967) who considers this species to be synonymous of *Physarum decipiens*.

Physarum leucophaeum Fr.

On a dead branch of *Quercus ilex* sp. *ballota*, Fuente la Reina, 27.X.1990, AH 13541. On wood of a deciduous tree, Fuente la Reina, 31.I.1990, AH 12544. On a cone of *Pinus pinaster*, Fuente la Reina, 1.X.1990, AH 12646. Idem, on dead branches of *Quercus* sp., 27.X.1990, AH 13541.

Physarum leucopus Link

On dead leaves, Villarreal de los Infantes, 6.II.1990, AH 12715. On dead leaves, Artana, 20.X.1990, AH 13587.

Physarum lividum Rostaf.
≡ *Physarum didermoides* var. *lividum* (Rostaf.) Lister

On a dead leaf of a deciduous tree, Villareal de los Infantes, 6.II.1990, AH 12536.

Physarum melleum (Berk. & Broome) Massee

On dead leaves of *Cistus ladanifer*, Benicarlo, 23.X.1990, AH 13559.
Easy to recognize because of its stalked globose sporocarps with a yellow-honey to grey yellowish peridium. *Physarum melleum* is an uncommon species in our country.

Physarum nutans Pers.

On wood of *Pinus* sp., Artana, 20.X.1990, AH 13547. On wood of *Cistus ladanifer*, Fuente la Reina, 27.X.1990, AH 13548. On unidentified wood, Villamalur, 2.II.1990, AH 13550.

Physarum straminipes Lister

On dead cladodes of *Opuntia ficus-indica*, Castellón (capital), 25.I.1990, AH 12565 and 13533. On a living stem of *Phoenix canariensis*, Oropesa del Mar, 25.XII.1981, leg.: G. Moreno, AH 12713.

Physarum vernum Sommerf.

On unidentified wood, Fuente la Reina, 27.X.1990, AH 12529.

Physarum viride (Bull.) Pers.

On cones of *Pinus pinaster*, Artana, 20.X.1990, AH 12658. Idem, on wood of *Pinus pinaster*, AH 13560.

Physarum viride **(Bull.) Pers. var.** ***incanum*** Lister, Monogr. Mycetozoa 47. 1894

On bark of *Olea europaea*, Artana, 20.X.1990, AH 13544, 13546 and 13552.
In "Mycetozoa" of LISTER (1925) the "var. *incanum*" Lister is described as having grey to yellowish sporocarps, with pale yellow fusiform capillitium nodes, which agrees with our collections. Macroscopically this variety is similar to *P. nutans* Pers., but the fact that it has yellow capillitium nodes separates it from this taxon and brings it close to discoloured forms of *P. viride*.
Our specimen AH 13546 has been confirmed as *P. viride* var. *incanum*, by Nannenga-Bremekamp who accepts this variety as

having constant characters. Nevertheless MARTIN & ALEXOPOULOS (1969) and FARR (1976) do not accept it.

Stemonitis fusca Roth

On wood of *Pinus* sp., Fuente la Reina, 27.X.1990, AH 12930.

Stemonitopsis amoena (Nann.-Brem.) Nann.-Brem.

On wood of *Pinus pinaster*, Fuente la Reina, 12.X.1990, AH 12649.

Trichia botrytis (J.F. Gmelin) Pers.

On unidentified wood, Fuente la Reina, 1.II.1990, AH 12531, 12532 and 12719. Idem, Retaule, 27.I.1990, AH 12533.

Trichia contorta (Ditmar) Rostaf.

On unidentified wood, Fuente la Reina, 31.I.1990, AH 12542. On a stem of palm tree, Retaule, 27.I.1990, AH 12688.

Trichia varia (Pers. ex J.F. Gmelin) Pers.

On unidentified wood, Fuente la Reina, 1.II.1990, AH 12556 and 12557. On woody remains, Retaule, 27.I.1990, AH 12720. On leaves and wood of *Eucalyptus camaldulensis*, 24.I.1990, AH 12559.

ACKNOWLEDGEMENTS

We wish to express our gratitude to Dr. J. Rammeloo for having revised and confirmed *Arcyria leiocarpa* and the different *Stemonitales*. To Mrs. Nannenga-Bremekamp for confirming *Diderma umbilicatum* var. *macrospora* and *Physarum viride* var. *incanum*, and for going carefully through the manuscript. To Mr. Verhaegen and A. Priego, technicians of the scanning electron microscope of the National Botanic Garden of Belgium and the University of Alcalá de Henares respectively. To the "Consejo Social" of the University of Alcalá de Henares (C. Illana) and to the (Ministerio de Agricultura, Pesca y Alimentación, Programa Nacional sobre Sistemas y Recursos Forestales" (G. Moreno) for the financial support which enabled us to visit these specialists. To M. Heykoop for the translation of the manuscript into English.

REFERENCES

BUYCK, B. (1982) The genus Diderma Persoon (Myxomycetes) in Belgium. *Bull. Jard. Bot. Nat. Belg.* 52: 165-209.

BUYCK, B. (1988). The Diderma spumarioides-globosum complex (Myxomycetes). *Bull. Jard. Bot. Nat. Belg.* 58: 169-218.

CABO, L. (1988). *Mixomicetos de la Alta Mahía*. Santiago de Compostela. Trabajo inédito.

CABO, L. (1989). Myxomycetes. Contribución al catálogo de Galicia. *Braña, Monogr.* 1: 67-72.

FARR, M.L. (1967). Notes on Myxomycetes. *Mycopath. Mycol.* 31: 305-313.

FARR, M.L. (1974). Some new myxomycete records for the neotropics and some taxonomic problems in the Myxomycetes. *Proc. Iowa. Acad. Sci.* 81: 37 -40.

FARR, M.L. (1976). *Myxomycetes. Flora Neotropica. Monograph no. 16*. 304 pp. The New York Botanical Garden. New York.

FARR, M.L. (1985). Notes on Myxomycetes. IV. Species collected in Brazil and Japan. *Nova Hedwigia* 41: 167-176.

GIRBAL, J. (1986). Fongs del Montseny. In.: J. Terradas & J. Miralles (Eds.), *El patrimoni biològic del Montseny, Catàlegs de flora i fauna* 1: 11-30.

GRACIA, E. (1981). *Estudio sobre la Flora, Fitosociología, Ecología y Corología de los Mixomicetes de España*. Universidad de Barcelona. Tesis doctoral.

GRACIA, E., M. HONRUBIA & X. LLIMONA (1981). Aportación al conocimiento de los hongos del SE de España II. Mixomicetes de la provincia de Albacete. *Anales Univ. Murcia, Ci*. 37(1-4): 63-79.

GRACIA, E., M. HONRUBIA & C. LADO (1982). Mixomicets nous o interessants per a la flora Ibérica i Balear. *Folia Bot. Misc.* 3: 95-99.

ILLANA, C. (1989). *Contribución al estudio de la clase Myxomycetes en España peninsular*. Universidad de Alcalá de Henares. Tesis de licenciatura.

ING. B. (1982). Notes on Myxomycetes III. *Trans. Brit. Mycol. Soc.* 78: 439-486.

KELLER, H.W.; U.H. ELIASSON; K.L. BRAUN & M.J. BUBENZUREY (1988). Corticolous Myxomycetes X: Ultrastructure and taxonomic status of Cribraria minutissima and C. confusa. *Mycologia* 80: 536-545.

KOWALSKI, D.T. (1975). The Myxomycete taxa described by Charles Meylan. *Mycologia* 67: 448-494.

LADO, C. (1992). Myxomycetes de reservas naturales Ibéricas. *Bol. Soc. Micol. Madrid* 16: 5-28.

LISTER, A. (1925, 2a. reeimpresión, 1972). *A monograph of the Mycetozoa*. 296 pp. 3a. ed. revisada por G. lister. Printed by order of the Trustees of the British Museum.

LOPEZ-SANCHEZ, E. (1985). *Estudio de los Mixomicetos del S.E. español*. Universidad de Murcia. Tesis de licenciatura.

LOPEZ-SANCHEZ, E., M. HONRUBIA, E. GRACIA & F.J. GEA (1986a). Estudio de los mixomicetos que fructifican sobre Opuntia ficus-indica L. en el SE de España Peninsular. *Anales Biol. (Murcia)* 10: 41-48.

LOPEZ-SANCHEZ, E., M. HONRUBIA, E. GRACIA & F.J. GEA (1986b). Notas sobre los Mixomicetos del sudeste español. *Bol. Soc. Micol. Madrid* 11: 11-19.

MARTIN, G.W. & C.J. ALEXOPOULOS (1969). *The Myxomycetes*. 560 pp. University of Iowa Press. Iowa.

MORENO, G., J.L. GARCIA-MANJON & A. ZUGAZA (1986). *La guía de Incafo de los hongos de la Península Ibérica.* Tomo I. Ed. Incafo. Madrid.

MORENO, G., C. ILLANA & M. HEYKOOP (1989). Contribution to the study of the Myxomycetes in Spain. I. *Mycotaxon* 34(2): 623-635.

MORENO, G., C. ILLANA & M. HEYKOOP (1990). Contribution to the study of the Myxomycetes in Spain. II. *Mycotaxon* 37: 1-24.

MORENO, G., C. ILLANA & M. HEYKOOP (1991). Contribution to the study of the Myxomycetes in Spain. IV. *Mycotaxon* 41: 113-125.

MORENO, G., C. ILLANA & M. HEYKOOP (in press). Spanish Myxomycetes. VI. Four interesting species belonging to the Stemonitales. *Cryptogamie Mycologie*.

NANNENGA-BREMAKAMP, N.E. (1982). Notes on Myxomycetes. XXI. The use of polarized light as an aid in the taxonomy of the Trichiales. *Proc. Kon. Ned. Akad. Wetensch., Ser.* C 85: 541-562.

NANNENGA-BREMEKAMP, N.E. & Y. YAMAMOTO (1983). Additions to the Myxomycetes of Japan I. *Proc. Kon. Ned. Akad. Wetensch., Ser.* C 86: 207-241.

RAMMELOO, J. (1983). Flore Illustrée des Champignons d'Afrique Centrale. *Fascicule 11. Echinosteliales et Stemonitales (Myxomycetes)*. Jardin Botanique National de Belgique.

MYCOTAXON

Volume XLVI, pp. 425-428 January-March 1993

VULPICIDA, A NEW GENUS IN PARMELIACEAE (LICHENIZED ASCOMYCETES)

JAN-ERIC MATTSSON[1] and MING-JOU LAI[2]

[1]*Department of Systematic Botany, Östra Vallgatan 18-20, S-223 61 Lund, Sweden,*
[2]*Systematic Mycology & Lichenology Laboratory, Institute of Microbiology Academia Sinica, Beijing 100080, China*

ABSTRACT

The genus *Vulpicida* J.-E. Mattsson & Lai gen. nov., based on characteristics of asci, pycnidia, secondary product chemistry, and morphology, is described. The new genus is a segregate of *Cetraria* Ach., comprising the species colored bright yellow by vulpinic and pinastric acids. The following new combinations are made; *Vulpicida canadensis* (Räsänen) J.-E. Mattsson & Lai, *V. juniperinus* (L.) J.-E. Mattsson & Lai, *V. pinastri* (Scop.) J.-E. Mattsson & Lai, *V. tilesii* (Ach.) J.-E. Mattsson & Lai, *V. tubulosus* (Schaerer) J.-E. Mattsson & Lai, and *V. viridis* (Schwein.) J.-E. Mattsson & Lai.

BACKGROUND

At present there is nomenclatural and taxonomical turbulence within the Parmeliaceae, with many new genera being described based on morphological and/or chemical characters, but without further documentation of sexual reproductive characteristics. Several genera within the family, e.g., *Parmelia* sensu Hale (1987), still contain species with comparatively large differences in ascomatal characters, although these species have a rather similar vegetative habit. Cladistic analyses have supported the taxonomic importance of characters in ascomata within the Parmeliaceae (Kärnefelt et al. 1992). Nine different ascus types are recognized within the family (Thell et al. 1992).

The yellow species, with vulpinic and pinastric acids, which have belonged to the genus *Cetraria* Ach. since the days of Acharius, have a type of ascus, that is different from that of both the *Cetraria islandica* group and the *Cetraria ciliaris* group (Kärnefelt et al. 1992). Instead of a narrowly clavate ascus with an apical ring structure (*Cetraria islandica* group), or a narrow ascus with uniseriately arranged globose spores (*Cetraria ciliaris* group which could be regarded as *Tuckermannopsis* Gyeln. s. str.), these yellow species have a broadly clavate ascus of the same type as one finds in, for example, *Letharia* (Th.Fr.) Zahlbr., *Melanelia* Essl., *Xanthoparmelia* (Vain.) Hale and *Usnea* Dill. ex Adans. These genera, together with perhaps ten or even twenty more, probably form a major monophyletic line in the Parmeliaceae, consisting at present of c. 1000 species.

The above genera with broadly clavate asci of intermediate size, compared to, e.g., *Hypogymnia* (Nyl.) Nyl. (small asci) or *Menegazzia* Massal. (large asci), can be arranged in two morphological groups: the terete, erect or pendant, usneoid group, and the foliose parmelioid group with almost adnate lobes. The species with vulpinic and pinastric acids are morphologically intermediate, with foliose but usually more or less erect narrow lobes. We believe this group of species is worthy of recognition as a distinct genus. Its segregation at the generic level is also supported by its citriform and sublageniform pycnoconidia, the black pycnidial wall, in combination with the usnic acid in the cortex, vulpinic and pinastric acids in the medulla, the primarily foliose habit, and the non-pseudocyphellate lower surface (Table).

Table. Comparison of some characters of *Vulpicida* and other cetrarioid genera.

Character	*Vulpicida*	*Cetraria*	*Nephromopsis*	*Tuckermannopsis*
Tholus	Strong amyloid reaction	Ring structure in tholus	Normal amyloid reaction	Normal amyloid reaction
Ascus	Broadly clavate	Clavate	Clavate	Cylindrical
Spores	Ellipsoid to subglobose	Ellipsoid to subglobose	Ellipsoid	Subglobose to globose
Apothecia	Marginal & laminal	Marginal & ± laminal	Marginal (Nephromoid)	± Marginal
Pycnidia	Marginal & laminal	Marginal, often on projections	± Marginal	Marginal & laminal
Pycnidial wall	Black pigmentated	Without pigments	Without pigments	Brown pigmentated
Pycnoconidia	Sublageniform & citriform	Citriform & bifusiform	Bifusiform	Bifusiform
Cortical chemistry	Usnic acid	Brown pigments ± Usnic acid	Usnic acid ± Atranorin	± Atranorin ± Usnic acid
Medullary chemistry	Vulpinic & pinastric acids (Pulvinic acid derivatives.)	Higher aliphatic acids ± ß-orcinol depsidones	Higher aliphatic acids ß-orcinol depsides & depsidones	Orcinol depsides & depsidones ± Higher aliphatic acids
Habit	Narrowly lobed, foliose, often rosette-forming	Narrowly lobed, foliose, erect	Broadly lobed, foliose, adpressed to substrate	Narrowly lobed foliose,± adpressed to substrate
Thallus color	Bright to greenish yellow	Brownish, or ± yellow	Glaucous yellow to yellowish grey	Pale to brownish olive
Color of lower side	As above	As above	Pale yellow, yellow brown to black	As above
Pseudo-cyphellae	Lacking	On lower surface	On lower surface	Lacking
Rhizines	± Present	Lacking	Present	± Present
Habitat ecology	Corticolous & terricolous	Terricolous	Corticolous ± saxicolous	Corticolous
Geographic distribution	Arctic-boreal-temperate regions of the Northern hemisphere	Arctic-boreal-temperate regions, ± bipolar	Himalayan to East-Asiatic regions	North American & East-Asiatic temperate regions

Previous authors have discussed the taxonomic status of the group which, will be described here as the genus *Vulpicida*. This group of lichens was first recognized as a distinct taxon by Räsänen (1952) who included six species in *Cetraria*, subgenus *Platysma*, sectio *Flavidae*, subsectio *Cucullatae*, [indef. rank] *Sulphureae*. One of these six species, *C. globulans* (Nyl.) Zahlbr., now classified within the genus *Nephromopsis* Müll. Arg., differs from the others in having secalonic acid as medullary substance instead of vulpinic and pinastric acids. Another of Räsänen's (1952) taxa, *C. canadensis* var. *viridis* (Schwein.) Räsänen is commonly accepted at the species level today (cf. Egan 1987), and consequentely, the new genus based on this group *Sulphureae* will contain six species. Nilson (1970), also argued for the taxonomic recognition of this group, mainly based on chemical characters.

THE GENUS *VULPICIDA*

Vulpicida J.-E. Mattsson & Lai, gen. nov.

Thallus foliaceus vel subfruticosus, pagina superior flava viridiflava vel viridis (cortex acidum usnicum continens), pagina inferior pallide flava area centrali nigricanti, rhizinis simplicibus instructa, pseudocyphellae desunt. Apothecia submarginalia vel laminalia, disco brunneo, asci late clavati sporis octonis ellipsoidalibus vel subsphaericis. Pycnidia marginalia vel laminalia, conidia sublageniformia vel citriformia. Medulla flava (acidum pinastricum et acidum vulpinicum continens).

Typus generis: *Vulpicida juniperinus* (L.) J.-E. Mattsson & Lai.

Basionym: Lichen juniperinus L., Species Plantarum 2: 1147 (1753). *Type:* Linnaeus' own material (LINN) is not in accordance with the protologue and cannot be used for the typification. A neotype will be selected (Mattsson in prep.).

Thallus foliose and forming rosettes, or subfruticose, lobes usually dorsi-ventral with at least raised tips, sometimes even terete; upper surface bright to rather dark yellow (usnic acid), sometimes greenish, often wrinkled or more or less folded; lower surface weakly yellow, central parts black, without pseudocyphellae; rhizinae laminal, black, almost never close to the margin and rather sparse, simple or irregularly branched. Apothecia submarginal or laminal, disc brown often with crenulate margin; asci broadly clavate, often with strong IKI reaction in tholus, wide ocular chamber, and large axial body; spores subspherical to almost spherical, simple, eight per ascus. Pycnidia often abundant, marginal or laminal, generally conspicuous, black, on projections, raised or immersed; medulla yellow to orange (pinastric and vulpinic acids); pycnidial wall at least partly with black pigment; conidia sublageniform or citriform.

Etymology: Of the Latin words vulpes, fox, and -cida (masc.), who kills. According to the peasants in the province of Härjedalen in Sweden, (Fries 1871; 105), these lichens can kill foxes but not wolves and dogs.

Species included

Vulpicida canadensis (Räsänen) J.-E. Mattsson & Lai, comb. nov.

Basionym: *Cetraria juniperina* var. *canadensis* Räsänen, Annals of the Missouri Botanical Garden 20:12 (1933).

Vulpicida juniperinus (L.) J.-E. Mattsson & Lai, comb. nov.

Basionym: Lichen juniperinus L. Species Plantarum 2: 1147 (1753).

Vulpicida pinastri (Scop.) J.-E. Mattsson & Lai, comb. nov.

Basionym: Lichen pinastri Scop., Flora Carniolica (ed. 2) 2: 382 (1772).

Vulpicida tilesii (Ach.) J.-E. Mattsson & Lai, comb. nov.

Basionym: *Cetraria tilesii* Ach., Synopsis Methodica Lichenum: 228 (1814).

Vulpicida tubulosus (Schaerer) J.-E. Mattsson & Lai, comb. nov.

Basionym: Cetraria juniperina (L.) Ach. var. *tubulosa* Schaerer, Lichenum Helveticorum Spicilegium: 372 (1836) ≡ Cetraria tubulosa (Schaerer) Zopf. =*Lichen juniperinus* (L.) Ach. var. *alvarensis* Wahlenb., Flora Suecica, (ed. 2): 827 (1826) ≡ *Cetraria alvarensis* (Wahlenb.) Vain.

Vulpicida viridis (Schwein.) J.-E. Mattsson & Lai, comb. nov.

Basionym: *Cetraria viridis* Schwein., in Halsey, Annals of the Lyceum of Natural History of New York 1:16 (1824).

We are most grateful to Per Lassen for help with the Latin diagnosis, Professor T. Ahti and Dr Irwin Brodo for valuable comments on the manuscript and to the latter also for revision of the English. Financial support from the Swedish Royal Academy of Sciences is greatly acknowledged.

LITERATURE CITED

Egan, R.S. 1987. A fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. - Bryologist 90: 77-173.

Fries, Th. M. 1871. Lichenographia Scandinavica. Uppsala.

Hale, M. E. 1987. A monograph of the lichen genus *Parmelia* Acharius sensu stricto (Ascomycotina: Parmeliaceae). - Smithsonian Contributions to Botany 66.

Kärnefelt, I., Mattsson, J.-E. & Thell, A. 1992. Evolution and phylogeny of cetrarioid lichens. - Plant Systematics and Evolution. In press.

Nilson, E. 1970. On the chemotaxonomy of some species of *Cetraria*. - Papers on Botany, Trans. Tartu State Univ. 9: 235-249.

Räsänen, V. 1952. Studies of the species of the lichen genera *Cornicularia*, *Cetraria* and *Nephromopsis*. - Kuopion Luonnon Ystäväin Yhdistyksen julkaisuja B 2(6): 1-53.

Thell, A., Mattsson, J.-E. & Kärnefelt I. 1992. The different ascus types in the Parmeliaceae and their significance. - 2nd Int. Lichenol. Symposium, Båstad Sweden, Abstract:7. Lund.

MYCOTAXON

Volume XLVI, pp. 429-436 January-March 1993

THE VALUE OF DRIED FUNGAL CULTURES FOR TAXONOMIC COMPARISONS USING PCR AND RFLP ANALYSIS

B.D. WINGFIELD AND M.J. WINGFIELD

Department of Microbiology and Biochemistry, University of The Orange Free State, P.O. Box 339, Bloemfontein 9300, South Africa

A DNA fragment of 370 base pairs in size was amplified, using PCR, from eleven-year-old dried culture material of *Ceratocystis adiposa*. This DNA fragment was compared with equivalent DNA amplified from DNA isolated from fresh material of the same isolate. The restriction patterns of both fragments were identical with each of eight restriction enzymes used in the study. It thus appears that the original DNA was preserved intact in the dried material. This technique should prove invaluable for comparisons between type specimens where only small amounts of dried material are available, as in the case of dried cultures.

Every validly described fungal species rests upon a type specimen lodged in an accredited herbarium. The rules of the International Code of Botanical Nomenclature, to which mycologists adhere, dictate that the type specimens including the holotype must be dead. They are thus in a form that will not change (Hawksworth, 1974). Living cultures of fungi are unacceptable as type specimens.

In the case of macrofungi such as mushrooms, puffballs and polypores, herbarium specimens are relatively easily preserved. Type specimens of these larger fungi tend to be relatively reliable. Considerable problems are experienced with type specimens of micro-fungi where sporocarps are minute. Here, herbarium specimens are usually preserved on the original substrate. In many cases, the amounts of material available for examination are extremely limited and may even be insufficient for meaningful morphological comparisons. In order to augment such collections, permanent preparations of characteristic structures on glass slides are often lodged. These can be extremely useful although mounting media do tend to dry out and slides often break. Another means of augmenting herbarium specimens of micro-fungi is to prepare dried cultures of these fungi which can be deposited in the herbarium package.

Where conidial states (anamorphs) sporulate profusely, dried cultures can be of tremendous value in comparisons.

Examination of, and comparisons with, type specimens lodged in herbaria have, until now, been based purely on morphological characteristics. Although these features are of great taxonomic value, they may also present problems such as misleading similarities arising from convergent evolution. Recent trends have therefore been to verify taxonomic conclusions using less subjective comparisons (Bruns *et al.*, 1991). Many techniques have been used including comparisons of metabolites, proteins, enzymes and various nucleic acids (Bartnicki-Garcia, 1970; Otrosina and Cobb, 1987; Kistler *et al.*, 1987; Gueho *et al.*, 1989; Bruns *et al.*, 1990).

The use of molecular and chemotaxonomic techniques in mycological studies has raised considerable problems in terms of the type of material available for comparison. Many of these techniques rely entirely upon living cultures. Such cultures are not available for the majority of fungi, and even when available cannot, as stated above be accepted as typifying a species. It has been estimated that fewer than 20 % of the known fungi are available in live culture collections (Hawksworth, 1990). The advent of the Polymerase Chain Reaction (PCR) has added a new and exciting dimension to the possibilities for comparisons based on minimal amounts of dried tissue. This technique involves the amplification of specific segments of DNA from extremely small amounts of starting material. For example, amplification of DNA from single spores has been reported (Lee and Taylor, 1990). Short fragments of DNA have also been amplified from *Magnolia* species estimated to be 17-20 million years old extremely old (Goldenberg *et al.*, 1990). Fragments of amplified DNA from different individuals can then be compared using Restriction Fragment Length Polymorphisms (RFLPs) (Vilgalys and Hester, 1990) or direct sequencing (Bowman *et al.*, 1992). Theoretically, it should be possible to amplify single copy genes from minute pieces of mycelium or even single spores lodged in herbaria.

Recognizing the power of PCR in fungal taxonomy, Bruns *et al.*, (1990) isolated DNA from 35 dried basidiocarps, representing 31 different species. Using the polymerase chain reaction a specific fragment of the mitochondrial large subunit ribosomal RNA gene was amplified. This region was sequenced and the sequences from the different individuals compared. In the case of micro-fungi, such small amounts of material are available that DNA isolations are far more difficult and sometimes impossible.

The intervening spacer regions (ITS1 and ITS2) of the ribosomal RNA (rRNA) gene battery are convenient sections of DNA to amplify

because they have been shown to exhibit a high degree of variation between species (Chambers *et al.*, 1986). However, the regions adjacent to ITS1 and ITS2 are highly conserved (White *et al.*, 1990). This allows specific priming from these areas into the more variable regions using the PCR reaction. The areas are rendered even more suitable by the fact that the organization in the human rRNA genes is such that amplification using these primers is not possible. Contamination is a problem and one of the most likely source of contaminating DNA (human DNA) in these herbarium specimens will not be amplified using these primers.

The aim of this study, was to amplify DNA directly from a dried fungal culture without any complicated DNA isolations, and to compare this with DNA isolated from a living culture representing the same collection. The fungus used in this study was *Ceratocystis adiposa* (Butler) Moreau. A living culture of this isolate was compared with a dried specimen on agar that had been prepared eleven years previously. PCR fragments from both the live culture and the dried material were compared to ascertain that the amplified product of the dried material was not an artifact or amplification of contaminating DNA.

A culture of *C. adiposa* from the culture collection of the junior author, maintained in the Dept. Microbiology and Biochemistry, University of the Orange Free State, Bloemfontein, R.S.A., was used in this study. A dried culture prepared from the same isolate of *C. adiposa* in 1979 by the junior author was used as the herbarium specimen for comparative purposes.

C. adiposa was grown in 500 ml of YPD broth (yeast extract (6%), peptone (12%), glucose (12%)) for three weeks. The fungal mycelium (11gm) was collected by centrifugation and washed once in 50 mM EDTA. This material was frozen at -70 ° C and lyophilized. The dry material was crushed with a pestle and mortar and the DNA isolated using the method of Chirgwin *et al.*, (1979).

The primers used in the PCR reaction were: 5'-GCATCGATGAAGAAC-3' and 5'-TCCTCCGCTTATTGA-3'. These primers amplify the ITS2 region of the rRNA gene battery which is the larger of the two intervening spacer regions. Total reaction volume was 100 μl and contained the following components: 100 pmoles of each primer, 2 units *Taq* polymerase (Promega) in a solution of 10 mM Tris-HCl (pH 9.0)/50 mM KCl/5.5 mM $MgCl_2$/0.1 mM DTT/0.01% gelatin/0.1% Triton X-100/250 μM of each of the deoxyribonucleotide triphosphates. These reactions were overlaid with liquid paraffin to prevent evaporation during the reaction. The reaction was started with an initial denaturation at 96 ° C for 5 minutes. The *Taq* polymerase was then added and this was followed by 35 cycles of the following regime: 20 sec at

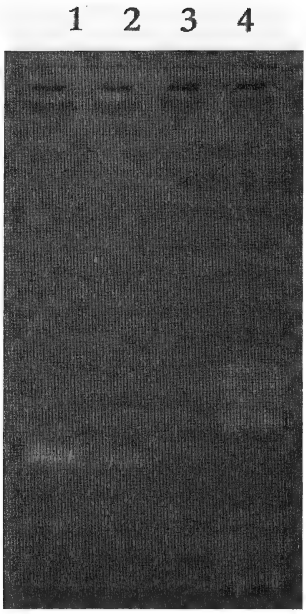


Figure 1. A 2 % agarose gel showing the amplified DNA products. Lane 1. DNA amplified from the DNA isolated from fresh *C. adiposa* material. Lane 2. DNA amplified from the dried *C. adiposa* culture. Lane 3. Control amplification containing no added DNA. Lane 4: pBR322 DNA cut with *Hae* III as size standard, the fragments sizes are 587, 540, 504, 458, 434, 267, 234, 213, 192 and 184 bp respectively.

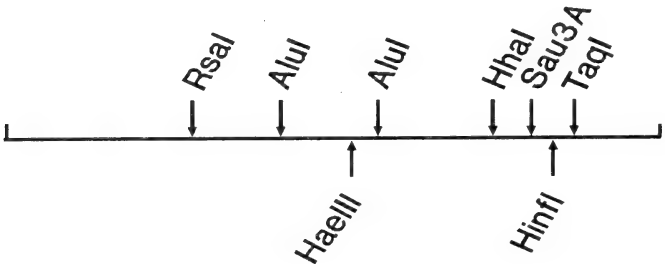


Figure 2. A diagrammatic representation of the restriction map of the ITS 2 region of *C. adiposa*. The fragment is 370 bp in size and the indicated cut sites are drawn to scale.

55 ° C, 30 sec at 72 ° C and 1 min at 92 ° C. To ensure a completely double-stranded product the reaction was ended by incubating at 72 ° C for 10 min.

The amplified products were assayed from 5 μl aliquots by gel electrophoresis in a 2% agarose gel containing 0.2 μg/ml ethidium bromide. The DNA bands were visualized under UV light and photographed through an orange plexiglass filter with Polaroid 665 positive-negative film.

For amplification from the dried herbarium specimen, a small amount of material was scraped off the dried agar and added, without any further preparation, to the reaction tube. The amount of material used was similar to that which would be used in preparing a slide for light microscopy.

A DNA fragment of 370 base pairs (bp) in size was amplified from both the purified DNA and the small piece of dried material (Fig. 1). The DNA amplified from the dried material was not in as high a concentration as that amplified from the isolated DNA.

The liquid paraffin was removed from the amplified DNA by chloroform extraction. The DNA was precipitated with isopropanol and one-tenth volume 3 M sodium acetate. The DNA was pelleted by centrifugation and the pellet washed twice with 70% ethanol. The DNA was dissolved in sterile deionised water and used for the restriction digests. The restriction enzymes *Alu* I, *Hha* I, *Hae* III, *Hpa* II, *Hinf* I, *Rsa* I, *Sau* 3A, and *Taq* I were used to digest the amplified DNA. These enzymes were purchased from Boehringer Mannheim (Mannheim, Germany) and used according to the manufacturer's instructions. The restriction fragments were electrophoresed on 6% acrylamide gels and the DNA visualized using the silver staining method of Perbal (1988).

Both the amplified fragments gave identical restriction patterns. The compiled restriction map of this DNA representing the ITS2 region of *C. adiposa* is shown in Fig. 2. The restriction enzyme *Hpa* II did not cut the DNA, whereas *Alu* I cut the fragment twice. All the other enzymes cut the DNA once.

In this study we have shown that it is possible to amplify a DNA segment directly from a fungal culture that has been dried for eleven years. This amplification is from the DNA preserved in the dried fungus and not from contaminating DNA because its restriction fragment pattern is identical to that of the fragment amplified from DNA isolated from a fresh culture of the same isolate.

The ITS2 region is known to be highly variable between species (Chambers *et al.*, 1986; Vilgalys and Hester 1990). We have found restriction fragment length polymorphisms using the same enzymes

between *C. adiposa, C. fimbriata* (Ellis and Halst.) and *C. moniliformis* (Hedgcock) Moreau [unpublished data]. This further confirms that the fragment amplified from the dried material is representative of DNA preserved in the herbarium specimen and not from contaminating DNA.

The potential for comparisons between dried fungal cultures and living cultures at the molecular level is great. This technique also has potential in comparisons between fungi that are difficult or impossible to culture. The amount of material needed for these comparisons is the same or potentially even less than that which is needed for classical morphological comparisons. It also has the advantage of not requiring any additional expensive and time-consuming preparation of the material.

One of the greatest problems with PCR is the possibility of contamination. While nothing can be done about the way cultures have been dried in the past, we would recommend that care should be taken to avoid contamination with foreign DNA during the preparation of new type material. The best way to achieve this would be to dry cultures under sterile conditions and avoid handling them as much as possible. If possible, attempts should also be made to store these dry cultures in sterile conditions. It may be necessary to develop new methods for handling and storing type material to ensure that molecular comparisons can be done at a future date.

The maintenance of a live culture collection requires a great deal of care, is labour-intensive, expensive and not always the best method of keeping material for comparative purposes. Fungi vary in the ease with which they can be cultured, and isolates often die out. Many organisms also change considerably with time in culture, making morphological comparisons difficult. The practice of keeping dried material is in many cases the only answer to some of these problems. However, with the availibility of molecular techniques such as PCR, it would also be desirable to isolate and keep the DNA of these cultures for subsequent comparisons. A simple approach might be to add vials of sterile dry mycelium to herbarium packets. Indeed, we recommend that mycologists follow this procedure when describing new species.

ACKNOWLEDGEMENTS

The authors wish to thank the Foundation for Research Development for financial support for this study and Dr. W. Bryce Kendrick for critical review of the manuscript.

REFERENCES

BARTNICKI-GARCIA, S. (1970). Cell wall composition and other biochemical markers in fungal phylogeny. In: *Phytochemical Phylogeny*; Proceedings of the Phytochemical Society Symposium Bristol (ed. J.B. Harborne). pp 81-103. Academic Press, London.

BOWMAN, B.H., TAYLOR, J.W., BROWNLEE, A.G., LEE, J., LU, S-D. AND WHITE, T.J. (1992). Molecular evolution of the fungi: Relationship of the basidiomycetes, ascomycetes and chytridiomycetes. *Molecular Biology of Evolution.* **9**, 285-296.

BRUNS, T.D., FOGEL, R. AND TAYLOR, J.W. (1990). Amplification and sequencing of DNA from fungal herbarium specimens. *Mycologia* **82**, 175-184.

BRUNS, T.D., WHITE, T.J. AND TAYLOR, J.W. (1991). Fungal molecular systematics. *Annual Review of Ecological Systematics* **22**, 525-564.

CHAMBERS, C., DUTTA, S.K. AND CROUCH, R.J. (1986). *Neurospora crassa* ribosomal DNA: sequence comparison of internal transcribed spacer and comparison with *N. intermedia* and *N. sitophila. Gene* **44**, 159-164.

CHIRGWIN, J.M., PRZBYLA, A.E., MACDONALD, R.J. AND RUTTER, W.J. (1979). Isolation of biologically active ribonucleic acid from sources enriched in ribonuclease. *Biochemistry* **18**, 5294-5299.

GOLDENBERG, E.M., GIANNASI, D.E., CLEGG, M.T., SMILEY, C.J., DURBIN, M., HENDERSON, D. AND ZURAWSKI, G. (1990). Chloroplast DNA sequence from a miocene *Magnolia* species. *Nature* **344**, 656-658.

GUEHO, E., KURTZMAN, C.P. AND PETERSON, S.W. (1989). Evolutionary affinities of heterobasidiomycetous yeasts estimated from 18S and 25S ribosomal RNA sequence divergence. *Systematic and Applied Microbiology* **12**, 230-236.

HAWKSWORTH, D.L. (1974). *Mycologists handbook.* An introduction to the principles of taxonomy and nomenclature in fungi. Commonwealth Mycological Institute, Kew.

HAWKSWORTH, D.L. (1990). The fungal dimension of biodiversity : magnitude, significance and conservation. *Mycological Research* **95**, 641-655.

KISTLER, H.C., BOSLAND, P.W., BENNY, U., LEONG, S. AND WILLIAMS, P.H. (1987). Relatedness of *Fusarium oxysporum* from crucifers measured by examination of mitochondrial and ribosomal DNA. *Phytopathology* **77**, 1289-1293.

LEE, S.B. AND TAYLOR, J.W. (1990). Isolation of DNA from fungal mycelia and single spores. *PCR Protocols : A guide to methods and applications.* (eds. M.A. Innis, D.H. Gelfand, J.J. Sninsky and T.J. White) pp. 282-287. Academic Press, San Diego, U.S.A.

OTROSINA, W.J. AND COBB, F.W.Jr. (1987). Analysis of allozymes of three distinct variants of *Verticicladiella wageneri* isolated from conifers in Western North America. *Phytopathology* **77**, 1360-1363.

PERBAL, B. (1988). Staining of DNA fragments. *A practical guide to molecular cloning* (2nd edn). pp. 811. John Wiley and Sons, New York.

VILGALYS, R. AND HESTER, M. (1990). Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several *Cryptococcus* species. *Journal of Bacteriology* **172**, 4238-4246.

WHITE, T.J., BRUNS, T., LEE, S. AND TAYLOR, J. (1990). Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. *PCR Protocols : A guide to methods and applications.* (eds. M.A. Innis, D.H. Gelfand, J.J. Sninsky and T.J. White) pp. 307-314. Academic Press, San Diego, U.S.A.

MYCOTAXON

Volume XLVI, pp. 437-444 January-March 1993

WATER-BORNE HYPHOMYCETES IN SINGAPORE, WITH A DESCRIPTION OF AN UNDESCRIBED SPECIES OF TRICHOCLADIUM

KEISUKE TUBAKI*, TECK KOON TAN** and YOSHIO OGAWA*

** College of Pharmacy, Nihon University, 7-7-1 Narashinodai, Funabashi-shi, 274 Japan*
***Department of Botany, National University of Singapore, Lower Kent Ridge Road, Singapore*

Abstract. Aquatic and other water-borne hyphomycetes were collected from foam and scum samples in Singapore. Twelve known and three undescribed species are recorded and illustrated. A new species, *Trichocladium singaporense* is described.

Introduction

During a short visit to Singapore by the senior author in September of 1987, we made a brief survey of aquatic and other water-borne hyphomycetes in foam and scum from streams and ponds. Since it does not appear that there are any previous records of aquatic hyphomycetes from Singapore, our brief observations may encourage others to make additional studies of these microfungi in Singapore.

In Singapore, the rain fall is abundant throughout the year and there is a squall almost every afternoon. Consequently, the streams examined are relatively permanent ones; they are located in the mountainous regions of the island. Streams in the rain forest are mostly small, shallow, well-aerated torrents with rapidly flowing water. Some of these rain forest streams tumble down to artificial reservoirs. Because of favorable temperatures and moisture for fungi, conidia of water-borne hyphomycetes are abundant in these waters. The general range of the hyphomycetous conidia is very much like that seen in papers by Nawawi (1985a) in the adjacent Malaysia, in Thailand (Tubaki et al., 1983), and East New Guinea(Tubaki, 1965).

Materials and Methods

Foam and scum collections were made from streams in Bukit Tema National Forest, Pierce Reservoir and its vicinity. The sample from the first site consisted of brownish foam held back by a barrier of twigs and leaves in the torrential stream. Scum samples from the reservoir were typical of those found at the edges of streams in the surrounding forest. The samples were taken back immediately to the Laboratory of Mycology, Botany Dept., National University of Singapore, and species of hyphomycetes in the

samples were identified under the microscope. Single-spore isolation was carried out using a Skerman micromanipulater. Cultures were grown on PDA (Difco) and Miura's agar medium (1970). Subsequent collections were also made at the same locality in 1991 (by Tan) and cultures were isolated by the same methods as above.

For electron microscopy, cultures were grown on Miura's medium, then fixed and dehydrated using essentially the method of Cole & Samson (1974). After critical drying with Hitachi HCP-2 (Hitachi, Japan), the materials were coated with gold in a Hitachi ion sputter E-102, then observed with a Hitachi scanning electron microscope S-2300.

Results and remarks on some species

Occurrence of aquatic and other water-borne hyphomycetes from Singapore is shown in Table 1. Species were identified on basis of detached conidia, or from cultures obtained from such conidia (indicated by an asterisk in Table 1). Twelve species referable to described taxa and three unidentified taxa are listed in the table. Several spore types not recognized are worthy of brief mention. One of these, obtained in pure culture, is described as a new species of *Trichocladium* below. Its liberated conidia are particularly common in foam and scum samples collected at Bukit Tema forest.

Trichocladium singaporense Tubaki, Tan et Ogawa, anam. sp. nov.

In PDA-cultura, mycelium ramosae, septatae, hyalinae vel pallide fuscae, 2-3 µm crassae, Cellulae conidiogene soliatria ex hyphis vegetativis repentibus lateraliter oriunde, cylindrica, 1 - 2 septata, 16 - 37 µm longa, basi 2.0 - 2.5 µm crassa, sursum incrassata, apice 3.0 - 3.5 µm crassa, conidia soliatria formatia, in statu adult collapsa, hyalina. Conidia (holothallic) cylindroclavata, apice rotundata vel fere truncata, basi truncata, 3 septatis transversalibus, (36) 40 - 52 (60) µm longa, apice 6.0 - 6.5 µm crassa, basi 4.0 - 4.5 µm crassa, crassitunicata, fuscae, basi vestigo conidiophori praedita. Conidia (holoblastic) termilaliter ex hyphis submertibus rependibus oriunda, catenata, proprie repetite ramosa, constricta ad septa, (10) 20 -50 µm longa et 3 - 4 µm crassa.

Growth on PDA, slow, flat, fuscous; reverse dark olive to almost black. Mycelium composed of branched, septate, hyaline to pale fuscous, 2-3 µm wide hyphae. Conidiogenous cells arise laterally on hyphae, cylindrical, 1-2 septate, short or long, 16 -

Table 1. Aquatic and other water-borne hyphomycetes from Singapore. Species identified from cultures obtained from conidia are indicated by an asterisk.

Angulospora aquatica Nilsson	*Scutisporus brunneus* Ando & Tubaki
Beltrania rhombica Penzig*	*Suctisporus* sp.
Campylospora parvula Kuzuha	*Tricladium* sp.
Condylospora spumigena Nawawi	*Tripospermum camelopardus* Ingold et al
Culicidospora sp. (*C. aquatica* P.)	*Triscelophorus acuminatus* Nawawi
Helicosporium sp.	*Trichocladium singaporense* Tubaki et al.*
Ingoldiella hamata Shaw	

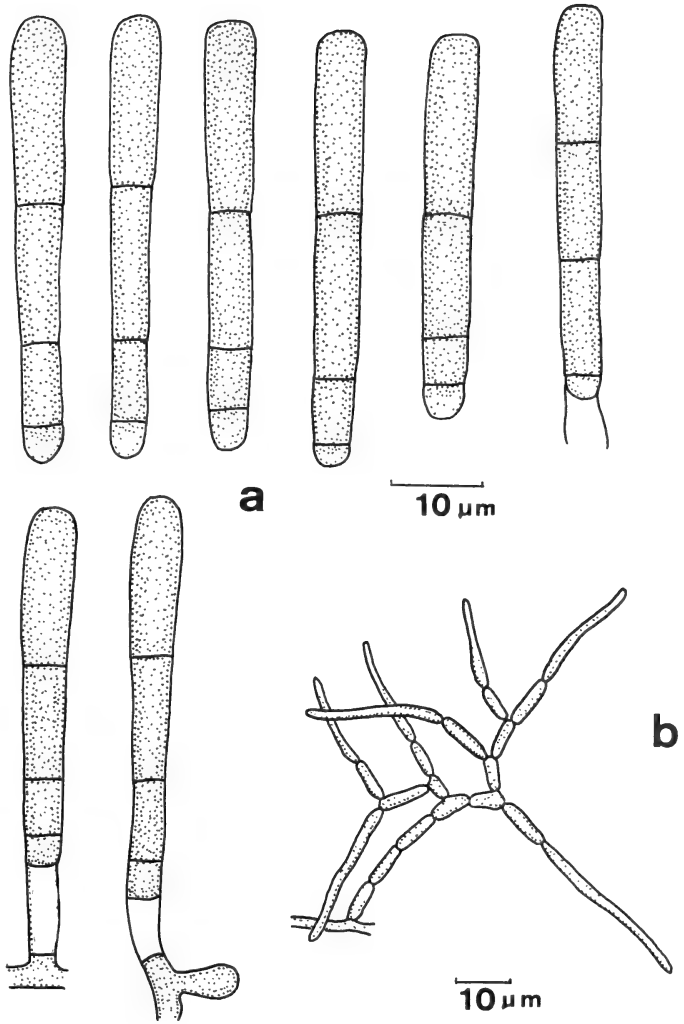


Fig.1 *Trichocladium singaporense*. a. Conidia of holothallic type.
b. Conidium development on submerged hyphae.

37 µm long, 2.0 - 2.5 µm diam. at base, up to 3.0 to 3.5 µm diam. at top, hyaline, producing a single conidium. Conidia are of the holothallic type (Fig. 1a and Fig. 2-4), liberated by breakdown of a separating cell at end of conidiogenous cell, cylindrical clavate, round to truncate at top, 3 septate, (36) 40 - 52 (60) x 6.0 - 6.5 µm, pale to dark fuscous. Another holoblastic type of the conidium develops on submerged and often anastomosed hyphae under the agar surface of colonies. This type of the conidium develops singly and laterally on submerged hyphae by a holoblastic manner (Fig. 1b). It consists of a moderately complex pinnate branched system of blastic cells (Fig. 5); each cell is long oval, (10) 20-50 x 3-4µm, pale brown.

Hab: From scum in a stream at Bukit Tema Natural Forest, Singapore, Aug. 1991. Holotype, a dried culture (TN-4), isolated by T.K.Tan, is deposited in the National Science Museum, Tokyo, Japan (TNS-F-176487). A living culture derived from the holotype is preserved in the Laboratory of Mycology, Depertment of Botany, National University of Singapore.

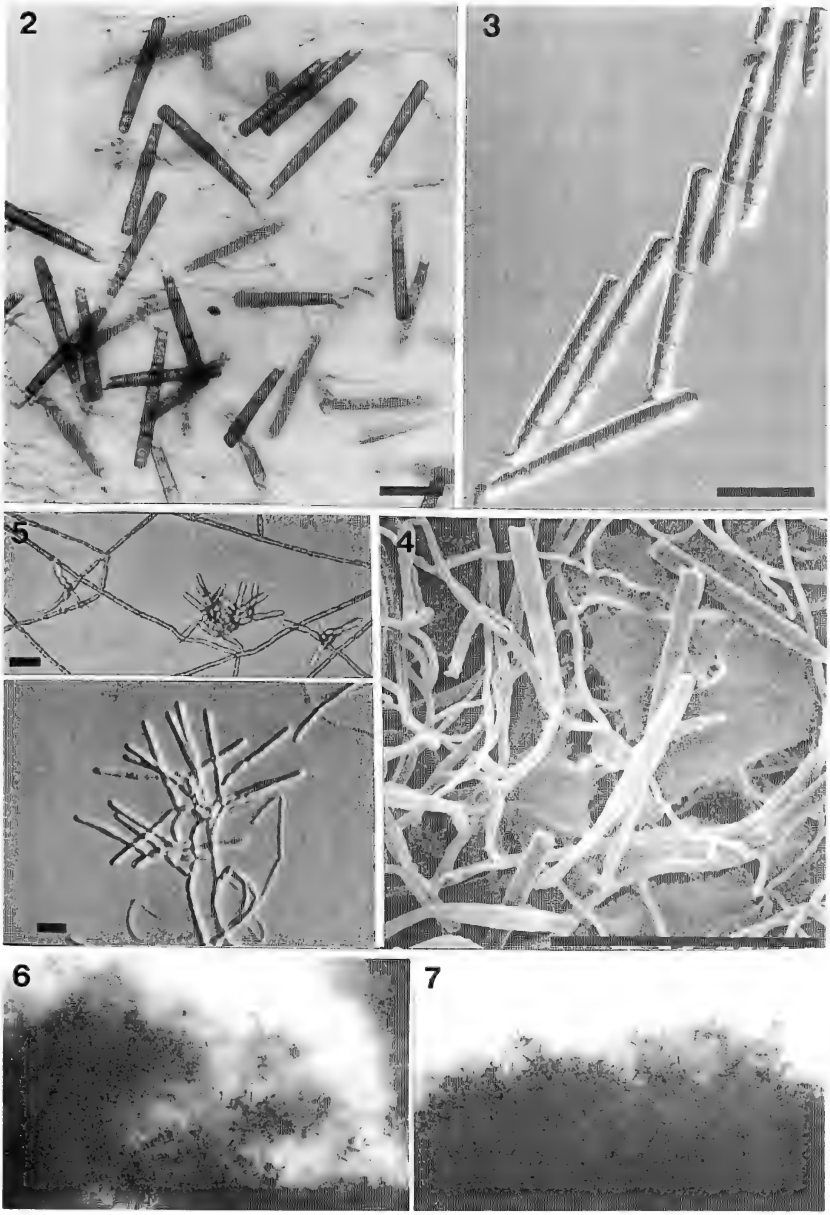
This *Trichocladium* is similar to *T. cylindroclavatum* Matsushima from subtropical Japan, but it differs clearly from the latter in the longer conidia with fewer septa. Development of the cylindrical conidia occurs readily near the margins of colonies on Miura's agar medium, so the species does not require the presence of water for conidial production. However, spraying water on the mycelial growth seems to stimulate sporulation. Plates of Miura's medium (8cm in diam.) were inoculated centrally with isolate TN-4, then incubated at 20°C until the colony diam. reached approximately 10 mm (after ca. one month). Conidia developed only sparingly under these conditions. Subsequently approximately 1 ml of distilled sterile water was sprayed over the surface of the agar plate. After three to four days, this water spraying was found to be stimulative for the sporulation (Fig. 6). Many more conidia developed on sprayed colonies than an unsprayed ones (Fig. 7). With another isolate, SG-3, which sporulates poorly on the agar medium, conidial development was apparently stimulated by this water spraying like that in the case of other typical aquatic hyphomycetes. This suggests that this *Trichocladium* species must be facultatively aquatic (Ingold, 1975) or, at the least, a streamside forest fungus. Liberated conidia germinate rapidly in scum: such germinating conidia were common in our samples. Because of the regular squalls, in Singapore, habitat of this species can be considered as alternating "terrestrial" and "aquatic". Squalls seem to be an important factor for conidial development and liberation in such leaf-inhabiting species. A similar condition exists with *Tripospermum* species and morning dew (Tubaki et al, 1985)

The conidia shown in Fig. 8 are probably of *Angulospora aquatica* Nilsson. This type of variably shaped conidium (Nawawi, 1985b) is fairly common in scum.

Beltrania rhombica Penzing (Fig.9) and other species of the genus are well-known terrestrial fungi. Their conidia, often found in stream foam samples, probably are washed into streams from leaf surfaces by rain.

Campylospora parvula Kuzuha was not uncommon in scum (Fig. 12). The conidium shown in Fig. 11 is of *Condylospora spumigena* Nawawi, first described from Malaysia (Nawawi, 1976).

The conidium illustrated in Fig.10, which had begun to germinate, is of a *Culicidospora* sp., possibly *C. aquatica* Petersen.



Figs. 2-7. *Trichocladium singaporense.*
Figs. 2-4. Conidia of holothallic type. Fig. 5. Branching system of blastic cells. Fig.6. Development of conidia on agar plate sprayed with distilled sterile water. Fig. 7. Development of conidia on the agar plate not sprayed with distilled sterile water. (Scale bar, Figs. 2&3=20μm; Fig. 4=50μm; Fig 5=10μm)

Helicosporium species (Fig.13) and other helicosporous conidia are common in scum.

A conidial aquatic basidiomycete, *Ingoldiella hamata* Shaw (Fig. 14), an anamorph of *Sistotrema hamatum* Nawawi & Webster (1982) was common in the scum.

The butterfly-shaped conidium (Fig. 15) is apparently of a species of *Scutisporus*, probably of *S. brunneus* Ando & Tubaki (1985). This species, fairly common in scum, is found also in East New Guinea (Tubaki, 1965) and Malaysia (Nawawi, 1985a). A similar but quite different spore-type is shown in Fig. 16 which may well be an undescribed species of this genus. Formal description of this fungus must await further observation under pure culture.

Tricladium species (Fig. 17) are common in scum.

Tripospermum species are not aquatic, bur their conidia were not infrequently found in scum throughout the study. These conidia must be carried by rain to streams from twigs and leaves in the surrounding forest. The conidium shown in Fig. 18 was probably produced by *T. camelopardus* Ingold et. al.

Conidia of a *Triscelophorus* sp. (Fig. 19) were fairly common in scum; they probably are of *T. acuminatus* Nawawi (Nawawi, 1975), a species first recorded from Malaysia. The conidia are characteristic with a septate main axis and four side arms.

The spores shown in figs. 20 -22 possibly are conidia of Hyphomycetes; many seem to belong to undescribed taxa. The conidium illustrated in Fig. 21 is common in scum at the Bukit Tema; barrel shaped, muriform, dark brown, with 2-3 hyaline appendages. The spore shown in Fig. 20 is unidentified. This tiny unicellular tri-radiate spore with a large central vacuole, not common in scum, is very close to the Nawawi's spore-type 4 (Nawawi, 1985) from Malaysia, but differ in having three hyaline appendages. The spore shown in Fig. 22 is also from an unknown species; it is dark brown, cuboidal, and has short hyaline appendages at each of the paler corner cells. It was found only in Bukit Tema, where it was common. This conidial type is close to that of *Diplocladiella tricladioides* Nawawi (Nawawi, 1985a), apart from the appendages, and is possibly that of an undescribed species of *Diplocladiella* or *Oncopodiella*.

Acknowledgments

Part of this study received financial support from a JSPS award to K. Tubaki, then at the University of Tsukuba. We thank Dr. R. J. Bandoni for his valuable comments on the manuscript.

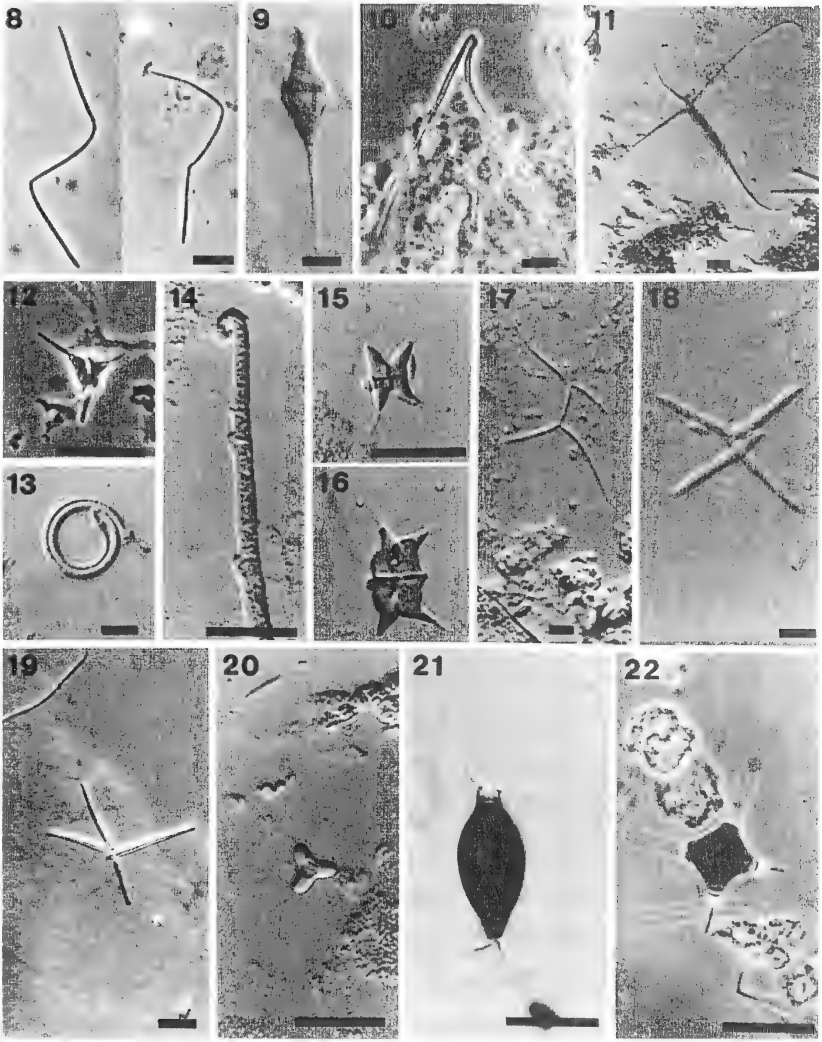
Literature cited

Ando, K. and Tubaki, K. 1985. Three new Hyphomycetes from Japan: *Anthopsis microspora, Scutisporus brunneus* and *Titaeela capnophila*. Trans. mycol. Soc. Japan 26; 151 -160.

Ingold, O. T. 1975. An illustrated guide to aquatic and water-borne Hyphomycetes with notes on their habitat. Freshwater Biol. Assoc. Sci. Bull. 30: 1-96.

Miura, K. and Kudo, M. Y. 1970. An agar-medium for aquatic Hyphomycetes. Trans. mycol. Soc. Japan. 11: 116 -118.

Nawawi, A. 1975. *Triscelophorus acuminatus* sp. nov. Trans. Brit. mycol. Soc. 64: 345 -348.



Figs. 8-22. Conidia of aquatic and other water-borne hyphomycetes from Singapore.
Fig. 8. *Angulospora aquatica* Nilsson. Fig. 9. *Beltrania rhombica* Penzing. Fig. 10. *Culicidospora* sp. Fig. 11. *Condylospora spumigena* Nawawi. Fig. 12. *Campylospora parvula* Kuzuha. Fig. 13. *Helicosporium* sp. Fig. 14. *Ingoldiella hamata* Shaw. Fig. 15. *Scutisporus* sp. (*S. brunneus* Ando & Tubaki?) Fig. 16. *Scutisporus* sp. Fig. 17. *Tricladium* sp. Fig. 18. *Tripospermum* sp. Fig. 19. *Triscelophorus* sp. Figs. 20 -22. undescribed species. (Scale ber, Fig. 8-22=20μm)

Nawawi, A. 1976. *Condylospora* gen. nov., a hyphomycete from a foam sample. Trans. Brit. mycol. Soc. 66: 363-365.

Nawawi, A. 1985a. Aquatic hyphomycetes and other water-borne fungi from Malaysia. Malay. Nat. Jour. 39:75 - 134.

Nawawi, A. 1985b. Some interesting Hyphomycetes from water. Mycotaxon, 24: 217 - 226.

Nawawi, A. and Webster, J. 1982. *Sistotrema hamatum* sp. nov., the teleomorph of *Ingoldiella hamata*. Trans. Brit. mycol. Soc. 78: 287 - 291.

Tubaki, K. 1965. Short note on aquatic spora in East New Guinea. Trans. mycol. Soc. Japan 6:11 - 16.

Tubaki, K. Tokumasu, S. and Ando, K. 1985. Morning dew and *Triposperumum* (hyphomycetes). Bot. Jour. Linn. Soc. 91: 45 - 50

Tubaki, K., Watanabe, K. and Manoch, L. 1983. Auatic hyphomycetes from Thai land. Trans. mycol. Soc. Japan 24: 451 - 457.

MYCOTAXON

Volume XLVI, pp. 445-451 January-March 1993

MORPHOLOGY OF EDGE LINES OF CHAINED IMMATURE CONIDIA ON CONIDIOPHORES IN POWDERY MILDEW FUNGI AND THEIR TAXONOMIC SIGNIFICANCE

SHIN, Hyeon-dong AND LA, Yong-joon*

Department of Horticulture, Kangnung National University, Kangnung 210-702, Korea and *Department of Agricultural Biology, Seoul National University, Suwon 441-744, Korea

줄 인 글

총 98 종의 기주식물에서 20종의 흰가루병균을 대상으로 무성세대에서 분생자병상의 연쇄상 미성숙 분생포자들이 갖는 외선을 두가지 집단으로 나누었다. 즉 외선이 陵狀인 흰가루병균은 *Cystotheca* 속과 *Erysiphe* 속이었고, 나머지 5 속인 *Arthrocladiella*, *Blumeria*, *Podosphaera*, *Sawadaia*, 그리고 *Sphaerotheca*는 모두 谷狀의 외선을 가졌다. 이와같은 외선의 형태적 차이는 신선시료 뿐만 아니라 건조표본시료에서도 뚜렷이 나타났으므로 무성세대에서 *Cystotheca* 속과 *Erysiphe* 속을 다른 5 속의 흰가루병균과 구별할 수 있는 분류학적 지표로써 이용될 수 있다. 특히 무성세대만 갖는 건조표본시료에서도 *E. cichoracearum*과 *S. fuliginea*를 구별할 수 있는 기준으로 활용될 수 있다.

ABSTRACT

The morphology of edge lines produced by chained immature conidia on conidiophores in powdery mildew fungi was studied. Twenty species of powdery mildew fungi from 98 host plant species were classified into 2 groups; one with sinuate edge and the other with crenate edge. Of the fungi examined, all species of *Cystotheca* and *Erysiphe* have sinuate edges and all species of *Arthrocladiella*, *Podosphaera*, *Sawadaia*, and *Sphaerotheca* have crenate edges. The difference between the two types was clearly seen in herbarial as well as fresh material. Therefore, the edge line of catenate conidia was suggested as a taxonomic character for the differentiation of *Cystotheca* and *Erysiphe* from the other genera of powdery mildew fungi in the conidial states. It is of special significance to differentiate *E. cichoracearum* from *S. fuliginea* in dried herbarium materials having only conidial state.

INTRODUCTION

The taxonomy of powdery mildew fungi has been based on the characteristics of the asci, ascospores, and perithecial appendages produced by their teleomorphs (Blumer 1967, Junell 1967, Kapoor 1967, Mukerji 1968, Yarwood 1973, Braun 1987, Zheng & Chen 1987,

Otani 1988). On the other hand, the anamorphic features of powdery mildew fungi have attracted little attention as taxonomic characteristics (Boesewinkel 1977, 1980, Yarwood 1978, Shin 1988).

Historically, Fresenius (1852) was the first author to point out that different species could be recognized by their conidiophores as these are not the same in all species. Recently, Boesewinkel (1977, 1980) prepared a practical key to identify anamorphs of powdery mildew fungi at species level on the basis of a combination of more than 12 morphological characteristics observed in conidia, conidiophores, appressoria, haustoria, fibrosin bodies, and mycelium.

Of the anamorphic characteristics of taxonomic value, production of conidia singly or in chains is one of the most clear and distinct characters (Boesewinkel 1980, Shin 1988). Shin (1988) suggested that the morphology of edge lines produced by the chained immature conidia on conidiophores was not uniform in his taxonomic work of Korean powdery mildew fungi. The present study was made to confirm his suggestion and to adapt the morphology of edge lines as a new character of taxonomic value.

MATERIALS AND METHODS

Fresh Fungi Examined. A total of 20 species of powdery mildew fungi producing conidia in chains from 98 species of host plants in Korea were collected between 1986 and 1990 (Table 1). Each of them was water-mounted at the day of collection and the morphology of edge line produced by the chained immature conidia on conidiophore was examined under a light microscope (400 X).

Herbarial Fungi Examined. To compare the morphology of edge lines between fresh and dried material, the infected leaves listed in Table 1 were dried and kept. They were examined in 1991, thus only 1 to 4 years old. In addition, old herbarial specimens provided by Dr. C.J. Kim from Korea and Dr. Y. Nomura from Japan were also studied (Table 2).

To restore the shriveled structures of powdery mildew fungi, a small piece of infected tissue was soaked in a few drops of lactic acid. This was carried out on a slide glass, holding it carefully about 5 seconds above a small flame. After cooled enough to handle, the fungus was detached from the leaf tissue and mounted in lactic acid for light microscopy (Shin 1988, 1990).

RESULTS AND DISCUSSION

Fresh Fungi Examined. The fresh fungi from 98 host plants species could be classified into 2 groups; one was those with crenate edge and the other with sinuate edge in their conidiophores. All species of *Cystotheca* and *Erysiphe* examined had the sinuate edge in their conidiophores (Table 1; Fig. 1-a, b). On the other hand, all species of the other 5 genera examined (*Arthrocladiella, Blumeria, Podosphaera, Sawadaia,* and *Sphaerotheca*) had the crenate edge (Table 1; Fig. 1-c, d, e).

Though the fungal species examined in this study were limited to 20 species on 98 host plant species collected in Korea, the morphology of edge lines could be first applied for the differentiation of the genera *Cystotheca* and *Erysiphe* from the other 5 genera in their anamorphic states.

Table 1. Edge lines of chained immature conidia on conidiophores in 20 species of the powdery mildew fungi examined from 98 species of host plants collected in Korea.

Powdery mildew fungi[z]	Host plants	Edge line[y]
A. mougeotii	*Lycium chinense*	C
B. graminis	*Agropyron tsukushiense* var. *transiens*	C
	Bromus japonicus	C
	Diarrhena japonica	C
	Hordeum vulgare	C
	Poa pratensis	C
	Triticum aestivum	C
C. lanestris	*Quercus* sp.	S
E. arabidis	*Arabis pendula*	S
E. artemisiae	*Artemisia capillaris*	S
	A. feddei	S
	A. japonica	S
	A. keiskeana	S
	A. montana	S
	A. princeps var. *orientalis*	S
	A. sieversiana	S
E. cichoracearum	*Achillea sibirica*	S
	Ambrosia artemisiifolia var. *elatior*	S
	Aster koraiensis	S
	A. laevis	S
	Chrysanthemum boreale	S
	C. moriflorum	S
	Eupatorium fortunei	S
	E. lindleyanum	S
	Hibiscus syriacus	S
	Humulus japonicus	S
	Inula helenium	S
	Liatris spicata	S
	Rudbeckia laciniata var. *hortensis*	S
E. galeopsidis	*Clinopodium chinense* var. *parviflorum*	S
	Stachys riederi var. *japonica*	S
E. rubiae	*Rubia akane*	S
	R. cordifolia var. *pratensis*	S
E. sordida	*Plantago asiatica*	S
P. clandestina	*Spiraea betulifolia*	C
P. leucotricha	*Malus pumila* var. *dulcissima*	C
P. tridactyla	*Prunus japonicus* var. *nakaii*	C
	P. serrata var. *spontanea*	C
	P. yedoensis	C
Sa. negundinis	*Acer negundo*	C
Sa. polyfida	*A. palmatum*	C
S. aphanis	*Duchesnea chrysantha*	C
	Geum japonicum	C
	Potentilla discolor	C
	P. fragarioides var. *major*	C
	P. freyniana	C
S. balsaminae	*Impatiens balsamina*	C
	I. noli-tangere	C
	I. textori	C

S. ferruginea	*Sanguisorba hakusanensis*	C
	S. longifolia	C
	S. officinalis	C
S. fusca	*Acalypha australis*	C
(= *S. fuliginea*)	*Ampelopsis brevipeduculata* var. *heterophylla*	C
	Arctium lappa	C
	Aster ageratoides	C
	A. pekinensis	C
	A. scaber	C
	A. tataricus	C
	A. yomena	C
	Bidens biternata	C
	B. frondosa	C
	B. parvifolia	C
	B. tripartita	C
	Calendula arvensis	C
	Catalpa ovata	C
	Circium pendulum	C
	Citrullus vulgaris	C
	Coreopsis lanceolata	C
	C. tinctoria	C
	Cosmos bipinnatus	C
	Cucumis melo	C
	C. sativus	C
	Cucurbita moschata	C
	Dahlia pinnata	C
	Erigeron annuus	C
	E. canadensis	C
	Helianthus annuus	C
	Hieracium umbellatum	C
	Lactuca indica var. *laciniata*	C
	L. raddeana	C
	Leibnitzia anandria	C
	Ligularia fischeri	C
	Metaplexis japonica	C
	Phtheirospermum japonicum	C
	Siegesbeckia glabrescens	C
	S. pubescens	C
	Taraxacum coreanum	C
	T. officinale	C
	T. platycarpum	C
	Youngia denticulata	C
	Y. japonica	C
	Y. sonchifolia	C
	Zinnia elegans	C
S. pannosa	*Rosa multiflora*	C
	R. multiflora var. *platyphylla*	C
S. phaseoli	*Phaseolus angularis*	C
	P. nipponensis	C

[z]: *A*, *B*, *C*, *E*, *P*, *Sa*, and *S* are abbreviations of *Arthrocladiella*, *Blumeria*, *Cystotheca*, *Erysiphe*, *Podosphaera*, *Sawadaia*, and *Sphaerotheca*, respectively.

[y]: C and S are abbreviations of crenate and sinuate, respectively.

Table 2. Edge lines of chained immature conidia on conidiophores in 7 species of powdery mildew fungi examined from herbarium specimens other than SMK[z].

Powdery Mildew fungi[y]	Host plants	Herbarium examined	Year collected	Edge line[x]
A. mougeotii	*Lycium chinense*	KCJ[w]	1980	C
B. graminis	*Hordeum vulgare*	KCJ	1980	C
E. artemisiae	*Artemisia montana*	YNMH[v]	1986	S
E. cichoracearum	*Ambrosia artemisiifolia* var. *elatior*	YNMH	1983	S
	Physalis alkekengi var. *franchetii*	YNMH	1954	S
S. balsaminae	*Impatiens balsaminae*	KCJ	1980	C
	I. noli-tangere	YNMH	1985	C
S. fusca	*Coreopsis lanceolata*	KCJ	1980	C
	Cosmos bipinnatus	KCJ	1977	C
	Cucumis sativus	KCJ	1982	C
	Cucurbita moschata	KCJ	1957	C
	C. moschata	KCJ	1976	C
	C. moschata	KCJ	1979	C
	C. moschata	KCJ	1980	C
	Lactuca indica var. *laciniata*	YNMH	1985	C
	Siegesbeckia glabrescens	YNMH	1985	C
S. phaseolus	*Phaseolus angularis*	KCJ	1957	C

[z]: SMK (mycological herbarium of Shin Hyeon-dong) was not listed in this table, since the herbarial materials examined were the same as those listed in Table 1 and the results were the same as those obtained from the fresh materials.
[y]: *A*, *B*, *E*, and *S* are abbreviations of *Arthrocladiella*, *Blumeria*, *Erysiphe*, and *Sphaerotheca*, respectively.
[x]: C and S are abbreviations of crenate and sinuate, respectively.
[w]: Dried materials collected in Korea by Dr. C.J. Kim.
[v]: Mycological herbarium of Yukihiko Nomura from Japan.

Herbarial Fungi Examined. In the material of the senior author's herbarium (SMK), *C.* sp. and *E.* spp. had sinuate edges and the species of the other 5 genera were characterized by crenate edges in their conidiophores without any exception. Also in other specimens (Table 2), the same result was obtained. Though the morphological differentiation in the edge lines between the two groups of fungi was not so clear as observed in fresh samples, it was not difficult to recognize whether the edge line of a specimen is sinuate or crenate.

Practically, it was of special interest that *E. cichoracearum* s. lat. and *S. fuliginea* s. lat. could be differentiated by the morphology of edge lines in herbarial as well as fresh samples. These two fungi have a very similar conidial morphology and were recognized on 434 common host plant species, especially on Cucurbitaceae and Compositae (Amano 1986). Therefore, the presence of conspicuous fibrosin bodies was emphasized as a key character which distinguishes *S.*

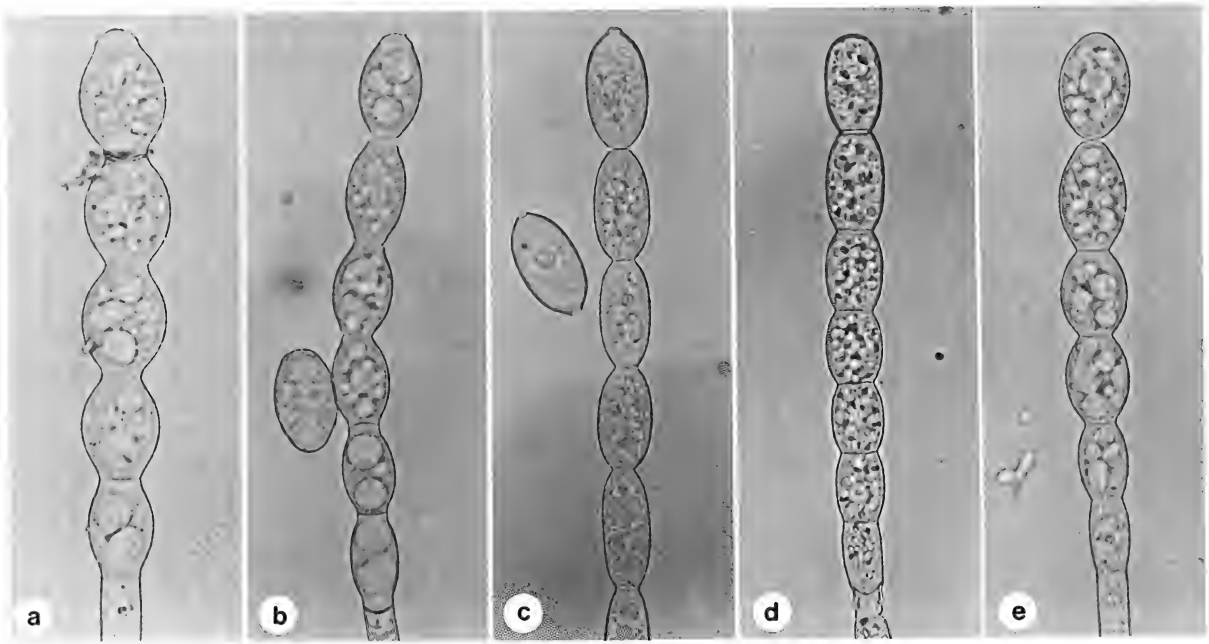


Fig. 1. Morphology of the upper part of conidiophores in fresh collections of several powdery mildew fungi. Note the sinuate edge line produced by catenate conidia in the left two species of *Cystotheca lanestris* (ⓐ) and *Erysiphe galeopsidis* (ⓑ) and the crenate edge line in the right three speices of *Blumeria graminis* (ⓒ), *Podosphaera tridactyla* (ⓓ), and *Sphaerotheca aphanis* (ⓔ).

fuliginea from *E. cichoracearum* in their conidial states (Ballantyne 1963, Boesewinkel 1977, 1980). The presence of fibrosin bodies in *S. fuliginea* is, however, influenced by environmental factors (Yarwood 1978). Furthermore, the fibrosin bodies disappear in herbarial specimens, which makes *S. fuliginea* indistinguishable from *E. cichoracearum* (Boesewinkel 1980).

Therefore, the utility of fibrosin bodies for the differentiation of these two fungi is limited to some extent. On the other hand, the morphology of edge lines could successfully be applied to herbarial as well as fresh material. It is expected that this principle is applicable to other powdery mildew species not examined in this study.

ACKNOWLEDGEMENTS

Thanks are due to Dr. C. J. Kim, professor emeritus of Kangwon National University of Korea, and Dr. Y. Nomura from Japan for providing some herbarium materials and to Dr. H. J. Boesewinkel from New Zealand for valuable discussions. Sincere appreciation is extended to Dr. U. Braun of Martin-Luther Universität, Germany, for helpful suggestions and a critical review of the manuscript.

REFERENCES

Amano, K. (1986) Host Range and Geographical Distribution of the Powdery Mildew Fungi. Japan Sci. Soc. Press, Tokyo. 741 pp.

Ballantyne, B. (1963) A preliminary note on the identy of cucurbit powdery mildews. Austral. J. Sci. 25:360-361.

Blumer, S. (1967) Echte Mehltaupilze (Erysiphaceae). Gustav Fisher, Jena. 436 pp.

Boesewinkel, H.J. (1977) Identification of Erysiphaceae by conidial characteristics. Rev. Mycol. 41:493-507.

Boesewinkel, H.J. (1980) The morphology of the imperfect states of powdery mildews (Erysiphaceae). Bot. Rev. 46:167-224.

Braun, U. (1987) A Monograph of the Erysiphales (Powdery Mildews). Beihefte zur Nova Hedwigia. Vol. 89. 700 pp. Borntraeger Publisher, Stuttgart.

Fresenius, G. (1852) Beitrage zur Mykologie. Heft 2. pp. 39-80. Bronner, Frankfurt. 111 pp.

Junell, L. (1967) Erysiphaceae of Sweden. Symb. Bot. Upsal. 19:1-117.

Kapoor, J.N. (1967) CMI Descriptions of Pathogenic Fungi and Bacteria. Nos. 151-160.

Mukerji, J.G. (1968) CMI Descriptions of Pathogenic Fungi and Bacteria. Nos. 182, 183, 186-190.

Otani, Y. (1988) Mycological Flora of Japan. Vol. Ⅲ. Ascomycotina. No. 2. Yokendo Ltd., Tokyo. 310 pp. (in Japanese).

Shin, H.D. (1988) Erysiphaceae of Korea. Ph. D. Thesis of Seoul Nat'l University, Seoul, Korea. 305+vi pp.

Shin, H.D. (1990) Identification of the causal fungus of sesame powdery midew in Korea. Kor. J. Plant Pathol. 6:8-12.

Yarwood, C.E. (1973) Pyrenomycetes: Erysiphales. *in* The Fungi, ed. G. C. Ainsworth *et al.* pp. 71-86. Academic Press, New York. 621 pp.

Yarwood, C.E. (1978) History and taxonomy. *in* The Powdery Mildews, ed. D.M. Spencer. pp. 1-37. Academic Press, New York. 565 pp.

MYCOTAXON

Volume XLVI, pp. 453-458 January-March 1993

LECANORA NAVARRENSIS, A NEW LICHEN SPECIES FROM NORTH SPAIN

J. ETAYO

Navarro Villoslada 16, 3º dcha, 31003-Pamplona, Navarra, España.

ABSTRACT: *Lecanora navarrensis* is newly described from northern Spain. It is characterized by its farinose yellowish thallus, with atranorin and fumarprotocetraric acid. Remarks on taxonomy and ecology of the species are given.

KEY WORDS: Lichens, *Lecanoraceae, Lecanora, Lecanora navarrensis* sp. nov., flora of Spain.

INTRODUCTION:

In a Ph. D. research, the author has been studying during last years the epiphytic flora of N-Navarra (N-Spain). Some interesting or undescribed species has been found. One of them is now described and named. The epithet *navarrensis* comes from Navarra, a region of Spain with a rich lichen flora, because of its geographical situation and well preserved woods. This taxon has some atypical features in the *Lecanora* genus, such as 1-septate spores, hyphal excipulum almost without algae, and branched-anastomosing paraphyses. This and a small-celled photobiont lead us to a tentative identification as a new species of the *Micarea* genus (Etayo, 1989). However, the thallus morphology, including the thick border, and asci are nearest to the large genus *Lecanora*, currently a polyphyletic, collective taxon which will certainly be divided into segregate genera in the future.

Lecanora navarrensis Etayo sp. nov.

Thallus crustaceous, epiphloeodicus, leproso-farinosus, strato corticale nullo, flavovirens vel sulphureus. Acidum fumarprotocetraricum et atranorina continens. Alga ad Trebouxiam probabiliter pertinens. Apothecia usque ad 0,5 mm lata, disco isabellino vel griseo maculatus, plano; excipulum albus vel disco concoloro, prominenti. Hymenium 40-55 µm altum, hialinum. Epithecium flavobrunneum vel griseo-olivaceus. Paraphyses ramosae et anastomosantes. Asci clavati, 8-spori, in apice cum tholo I+ caerulei, typus *Lecanorae*. Sporae ellipsoideae, rectae vel curvulae, normalis 1-septatae 8-13 x 2,5-3,5(4) µm. Conidiomata non visa. Ad corticem.

Typus: **Spain**, Navarra, Oronoz-Mugaire, Señorío de Bértiz, UTM 30TXN1579, 200 m, in *Prunus lusitanica*, 5 June 1988, *J. Etayo* (BCC-holotypus, hb. Etayo-isotypi).

Additional specimens examined: **Spain**: ibidem, *J. Etayo*, hb. Etayo 4212, 4214, 6292.

Thallus corticolous, crustose, epiphloeodal, usually forming small patches less than 2 cm diam, thin, continuous and well delimited by a black hypothalline line. Surface totally pulverulent-farinose, ecorticate, sulphur yellowish or greenish yellow, with soredia 12-20 (25) µm. *Photobiont* green, chlorococcoid (*Trebouxia*?), cells, more or less isodiametric 5-8(10) µm diam, hyphae apparently not penetrating into the cells.
Apothecia scarce, round, 0,3-0,5 mm diam, plane, concave when young; light brownish disc and with whitish thick margin that is smooth and non sorediate; both margin and disk can be irregularly stained dark grey. *Hymenium* 40-55 µm high, hyaline, I+ blue. *Epithecium* yellowish, with coarse granules; the grey part of disc has a dark olivaceous colour that turns light green with K. Hypothecium hyaline, higher than 100 µm, prosoplectenchimatic composed of very thin and dispersed hyphae. *Excipulum*, 50-60 µm thick, composed of outwardly radiating branched and

anastomosing hyphae, which separate in K, I-, with only a few groups of algal cells in the lower part. *Paraphyses* 1-1,5 µm thick, much branched, specially near the apex, anastomosed; apices not thickened. *Asci* clavate, 8-spored, with an amyloid apical apparatus, *Lecanora*-type (Hafellner, 1984). *Ascospores* simple or more frequently 1-septate, ellipsoid, straight or slightly curved and guttulate, without halo, 8-13 x 2,5-3,5(4) µm.

Pycnidia not seen.

Chemistry: Thallus K-, KC-, C-, PD+ red, UV-; atranorin (traces) and fumarprotocetraric acid by TLC.

OBSERVATIONS

Because of the high proportion of 1-septate spores and a margin almost without algae, except in its lower part, it would seems that we have a *Catillaria* or *Catinaria* species. However, its branching excipulum made of radiating hyphae, relate this species more to *Lecanora symmicta* group. Moreover, some of the species of this genus have, although in less proportion, 1-septate spores (Giralt & Gómez-Bolea, 1991). However, the ascus of *L. navarrensis* is more related to *Lecanora*-typ and, so it is different to *L. symmicta*-typ, and the paraphyses are more richly branched than in *Lecanora* genus. Because of its yellowish, completely farinose, ecorticate thallus and tiny soredia, it resembles *Lecanora expallens*, but this last species react C+ orange because the presence of thiophanic acid (although in some samples of N Spain, the reaction is not very clear, Etayo, 1989). Unlike *L. expallens* the thallus of *L. navarrensis* reacts C-, PD+ red, because of its fumarprotocetraric acid content. Moreover, the apothecia structure, without a typical amphitecium, and 1-septate spores are diagnostic.
Another species it could be mistaken for is *Catinaria pulverea* also of oceanic distribution and very variable, both in soredial development and in ascomatal pigments. Its rather thick and fissured thallus usually has erumpent soralia which can

fuse, forming a completely leprose crust, P+ red. In this case, however, the thallus contains fumarprotocetraric acid, atranorin and zeorin, the soredia are coarser, and the algal cells are larger. Its facies in the field is very different, because it forms large thalli of a grey-whitish colour. Some reproductive characters are also similar, like the presence of 1-septate spores, but they are larger in *C. pulverea*, of 12-18 x 5-6 µm (Poelt & Vezda, 1981), 15-18 x 7-9 µm (Galloway, 1985) and 15-19 x 6-9 µm (Etayo, 1989, in population from N Spain). The structure of its exciple and hypothecium and the nature of the apothecial pigments are different also.

Mycoblastus sterilis has the same chemical composition, but looks quite different on account of its more or less excavate to slightly concave soralia often becoming confluent, but always with a bluish grey colour. Furthermore, the algal cells and the size of soredia are larger than in *L. navarrensis*.

Other PD+ red species, such as *Schismatomma quercicola* with *Trentepohlia* and pale grey-brown thallus with pinkish tinge (Coppins & James, 1989), *Pertusaria pupillaris* or *Lecidea cinnabarina*, with different ascomata and spores are less likely to be mistaken with our new species.

ECOLOGY AND DISTRIBUTION

Lecanora navarrensis has been collected from one station: valle de Bertizarana, N Navarra, very rich in epiphytic lichens, between the coline and

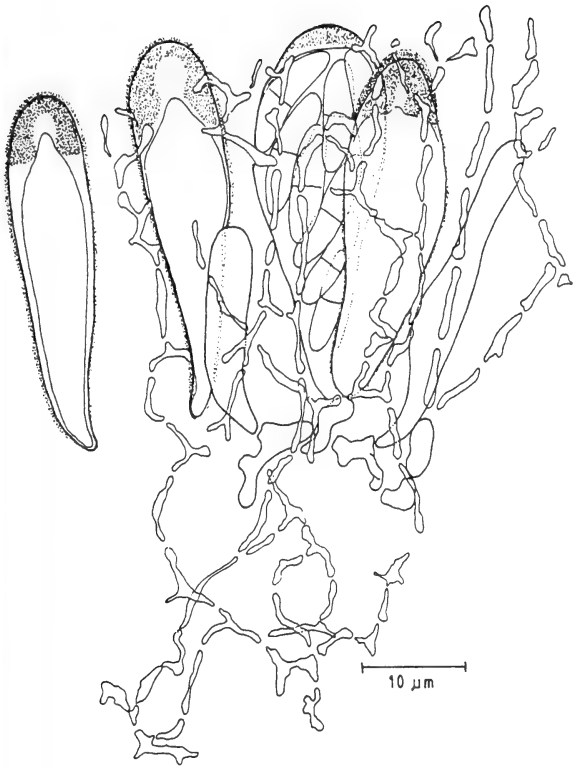
---

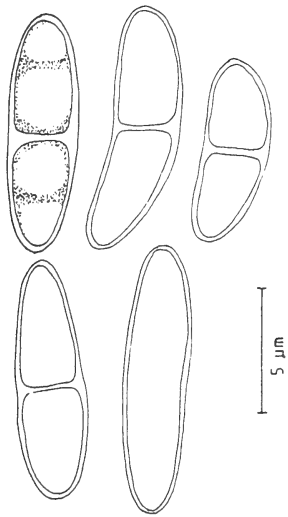
Figures:

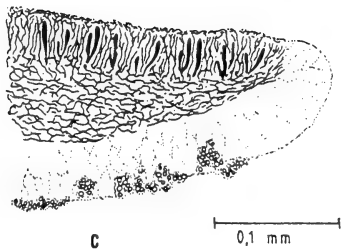
A: hamathecium of *Lecanora navarrensis* made of anastomosed, branched paraphyses and hypothecium with similar hyphae (lactophenol blue). The *Lecanora* ascus is represented with KI.

B: spores of *L. navarrensis*, the former stained with lactophenol blue.

C: transverse section from an apothecium also in lactophenol blue.


A
10 µm


5 µm
B


0,1 mm
C

montane belt in a hyperhumid ombroclimate (1600-1800 mm/year) on an imported phorophyte *Prunus lusitanica*, accompanied by *Anisomeridium biforme*, *Catinaria pulverea*, *Haematomma leprarioides*, *Heterodermia obscurata*, *Megalospora tuberculosa*, *Menegazzia terebrata*, *Rinodina isidioides*, *Thelopsis rubella*, *Zamenhofia coralloidea*, and other more common species. This taxon should be sought for in other oceanic zones from southern Europe.

ACKNOWLEDGEMENTS

I am much indebted to B. Coppins and T. Tonsberg for their valuable comments, to B. Coppins and X. Llimona for revising the manuscript and to the DGICYT, for a grant assigned to the project PB89-0518-C02-01.

LITERATURE CITED

COPPINS B. J. & P. W. JAMES (1989): The identity of "*Lecidea cinnabarina*" in the British Isles.- Lichenologist **21**(3): 237-242.

ETAYO, J. (1989): Líquenes epifitos del norte de Navarra.- Tesis Doctoral ined., 980 pp, Universidad de Navarra.

GIRALT, M. & A. GOMEZ-BOLEA (1991): *Lecanora strobilinoides*, a new lichen species from north-eastern Spain. Lichenologist **23**(2): 107-112.

GALLOWAY, D. J. (1985): Flora of New Zealand. Lichens.- P. D. Haselberg, Government printer, Wellington, New Zealand, 662 pp.

HAFELLNER, J. (1984): Studien in Richtung einer natürlicheren Gliederung der Sammelfamilien Lecanoraceae und Lecideaceae.- Nova Hedw., Beih. **79**: 241-371.

POELT J. & A. VEZDA (1981): Bestimmungsschlüssel europäischer flechten. Ergänzungsheft II.- Bibl. Lichenol. **16**: 1-390.

MYCOTAXON

Volume XLVI, pp. 459-483 January-March 1993

REVISION OF SCHIZOPARME (DIAPORTHALES, MELANCONIDACEAE)

GARY J. SAMUELS
USDA-ARS; Systematic Botany and Mycology Laboratory; Rm. 304, Bldg. 011A, BARC-West; Beltsville, Maryland 20705

MARGARET E. BARR
9475 Inverness Ave., Sidney, British Columbia V8L 3S1, CANADA

AND

ROSALIND LOWEN
The New York Botanical Garden, Bronx, New York 10458-5126

ABSTRACT

Schizoparme is found to be a genus of the Diaporthales, family Melanconidaceae. *Gnomoniella destruens* and *Nectriella versoniana* are recombined in *Schizoparme*. The new species *S. angustispora*, *S. botrytidis*, *S. stromatica*, and *S. terminaliae* are proposed. *Coniella castaneicola* is the anamorph of *S. straminea*; *C. granati* is the anamorph of *S. versoniana*. The anamorph of *S. stromatica* is possibly a species of *Coniella*.

Key Words: *Coniella*, *Gnomoniella*, *Nectriella*, *Schizoparme*, Diaporthales, Melanconidaceae

Schizoparme Shear was originally described for one species, *S. straminea* Shear, with an unnamed pycnidial anamorph (Shear, **1923**). *Schizoparme straminea* was reportedly found on dead leaves of a wide variety of woody and herbaceous dicotyledonous plants (Shear, **1923**). No additional species have been added to *Schizoparme*.

Shear (**1923**) thought the genus to be related to *Physalospora* Niessl. *Physalospora*, based on its type *P. alpestris* Niessl, is

today included in the the Hyponectriaceae Petrak (Barr, **1970**, **1990**). We do not see a close relationship between *Schizoparme* and *Physalospora*. Dodge (**1936**) considered that *S. straminea* and *Nectriella versoniana* Sacc. *et* Penz. were synonymous, thus relegating *Schizoparme* to synonymy with *Nectriella* Nitschke (*non* Saccardo, which is *Pseudonectria* Seaver), a genus of the Hypocreales (Lowen, **1991**). Rogerson (**1970**) retained both genera in the Hypocreales, separating *Nectriella* and *Schizoparme* on the basis of bicellular ascospores in species of the former and unicellular ascospores in the latter. He did not comment on the synonymy of *S. straminea* and *N. versoniana*. The placement of *Schizoparme straminea* has been controversial. The species was listed as *Pseudonectria* in Eriksson and Hawksworth (**1987**), suggested to be *Nectriella* by Dodge (**1936: 95**), and included as a member of the Sphaeriaceae by Clements and Shear (**1931**: 261).

Shear (**1923**) confirmed the link between *S. straminea* and its pycnidial anamorph through several single ascus isolations. The name of this anamorph has been disputed (Maas *et al.*, **1979**; Sutton, **1980**) and we have followed Sutton (**1980**) and Nag Raj (pers. comm.) in referring to it as *Coniella castaneicola* (Ellis *et* Everh.) Sutton. Dodge (**1936**) obtained *Phoma granati* Sacc. [= *Coniella granati* (Sacc.) Petrak *et* H. Sydow] in ascospore isolates of *Nectriella versoniana*.

Schizoparme is not a genus of the Hypocreales (*sensu* Rogerson, **1970**; Barr, **1990**). Perithecia of *S. straminea* have dark, brown, walls. The ostiolar canal is lined with short, stout periphyses. Sterile filaments were not seen among asci. The asci are sessile and float free of the hymenium in which they form. The ascal apex has an inamyloid apical ring which, in optical section, appears to be formed of two discrete, refractive bodies. The *Coniella* anamorph has dark pycnidia that form independently of perithecia, and brown conidia that form on narrow phialides. The combined characters of *S. straminea* and its anamorph exclude *Schizoparme* from the Hypocreales. Bright or pale-colored pigmentation of perithecia, asci that remain attached to the hymenium, a shallow ascal ring, and

conidiomata within which perithecia are initiated (e.g. *Tubercularia*), are typical of the Hypocreales. The asci that float free and that have a characteristic apical ring, the brown pigmentation of the perithecia and pycnidia, and the herbicolous habit of *S. straminea* indicate that this is a genus of the Diaporthales.

Schizoparme is distinctive in the Diaporthales. Perithecia of *S. straminea* are widely erumpent, splitting the host epidermis with about four radial slits and partially breaking out of host tissue. The only stromatic tissue is represented by an epistromatic region of small, pale-colored cells around the ostiolar opening that are presumed to function in rupture of the epidermis. These cells remain adherent to the perithecial wall after emerging from the host, appearing as tan warts or scales. The epistroma is reiterated in the pycnidial apex (see Fig. 3 in Shear, **1923**). The light-colored warts give the perithecia a hypocreaceous aspect, but the similarity is superficial. An epistroma is conspicuous at the pycnidial apex. This is well illustrated by Shear (**1923**, Fig. 3; Pl. 13, Fig. 2).

In recent years we have received collections of six pyrenomycetes that are remarkably similar in morphology and anatomy, and that are more or less similar to *S. straminea* in perithecial characters. Perithecia are generally solitary or gregarious in groups of a few and, while appearing to be superficial, are clearly erumpent through host tissue. Perithecia are globose with a centrally situated, acute papilla that is no more than 100 μm high. The papilla is not visible in collapsed perithecia, which are deeply cupulate. The perithecia appear light brown and warted around the perithecial apex when young because of the pallid epistromatic cells. With age this layer is absent or reduced, the warts less prominent, and the perithecial wall appears dark brown or black. The perithecial wall of all species is thin and anatomically uniform, composed of two or three intergrading layers. The outermost layer includes the epistroma. Cells of the middle layer are angular and have pigmented walls; cells of the middle region can have one or more minute pores similar

to, but smaller than, the Munk pores of the Nitschkiaceae (Sordariales *sensu* Barr, **1990**) and other pyrenomycetes (Jensen, **1985**). Cells of the inner layer are flattened and compressed; their walls are nonpigmented. Asci of most are freed into the centrum and most often have a diaporthaceous apical ring that appears in optical section as two refractive bodies. Asci of *S. angustispora* remain clumped; individual asci cannot easily be segregated from the mass of asci. There is variation in the nature of the ring in the ascal apex. The ring in the type of S. *destruens* is now barely visible (illustrated as distinct by Barr and Hodges, 1987). The ascal ring of *S. straminea, S. botrytidis, S. terminaliae,* and *S. versoniana* is conspicuous. The apex of *S. angustispora* is thin and simple. A long channel was seen in the ascal apex of *S.* stromatica, but there was no ring. Ascospores of species are unicellular, ellipsoidal to inequilateral to subglobose. Ascospores of most slowly become brown in varying degrees and in any microscopic preparation more spores are hyaline than pigmented. Ascospores of most herbicolous species tend to remain hyaline (*S. angustispora, S. straminea*, and *S. versoniana*) but those of others (*S. destruens* and *S. terminaliae*) are slightly brown. Ascospores of the lignicolous species, *S. stromatica* and *S. botrytidis*, become very dark brown and opaque. Coelomycetous anamorphs are known for two of these species.

Only two of these taxa have been described, *Gnomoniella destruens* Barr *et* Hodges (Barr and Hodges, **1987**) and *Nectriella versoniana*. Dodge (**1936**) synonymized *S. straminea* under *N. versoniana*. However, our study of type specimens of the two ascomycetes and comparison of the described anamorphs confirms that these are distinct but closely related species, differing in the sizes of their ascospores and conidia. *Gnomoniella destruens*, *N. versoniana* and the remaining four species differ from typical *S. straminea* in having more nearly superficial perithecia, but there is a continuum from the immersed perithecia of *S. straminea* to perithecia that are superficial on an erumpent stroma. Perithecia of two

lignicolous species, *S. botrytidis* and *S. stromatica*, are superficial on basal stromata, but no other perithecial characters separate them from *S. straminea*. *Nectriella versoniana* and *Gnomoniella destruens* belong in *Schizoparme*.

Species of *Schizoparme* are found in widely separated, but usually tropical, geographic areas. They occur on apparently unrelated dicotyledonous hosts where they are parasitic. *Schizoparme straminea* (Maas *et al.*, **1979**) and *S. versoniana* (Dodge, **1936**; as *Nectriella*) can cause rot in fruit of strawberry. *Coniella castanaeicola* (Ell. & Everh.) Sutton, the anamorph of *S. straminea*, and *C. granati* (Sacc.) Petrak *et* H. Sydow, the anamorph of *S. versoniana*, are reported from a wide range of dicotyledonous host plants (Sutton, **1980**). *Schizoparme destruens* and *S. angustispora* were found on leaves and petioles of members of the Myrtaceae in Hawaii (*Eucalyptus globulus, Psidium guajava*). *Schizoparme destruens* was shown to be the cause of serious defoliation of seedlings of *Eucalyptus globulus* (Barr and Hodges, **1987**; as *Gnomoniella*). *Schizoparme terminaliae* sporulated on living leaves of *Terminalia superba* (Combretaceae) in Ecuador. The fungus was associated with more or less circular necrotic lesions measuring up to several centimeters in diameter; one or two such large lesions affected more than half of the leaf surface and resulted in premature abscission (Hodges, pers. comm.). The habitat of *S. angustispora* and *S. terminaliae* suggests a pathogenic potential as well. *Schizoparme botrytidis* and *S. stromatica* occur on bark of undetermined dead trees in Puerto Rico and Brazil, respectively. *Schizoparme botrytidis* appeared on a tree in Puerto Rico that was killed in 1989 by the winds of Hurricane Hugo.

It is difficult to place *Schizoparme* within the Diaporthales. The typical case in the order is for perithecia to remain immersed in host tissue and to have coelomycetous anamorphs. Barr (**1990**) distinguished between the Gnomoniaceae and the Melanconidaceae essentially on the basis of ascospore characters. Spores in the Gnomoniaceae are hyaline and thin-walled; spores in the Melanconidaceae are hyaline or

pigmented but "firm-walled." While *S. straminea* itself could be referred to the Gnomoniaceae, the other species with their nearly superficial perithecia, and dark ascospores and conidia argue for the Melanconidaceae. *Schizoparme* is thus emended to include species that have nearly completely immersed to superficial and stromatic perithecia.

Schizoparme C.L. Shear, Mycologia 15: 120. 1923, *emend* Samuels, M.E. Barr *et* Lowen

Ascomata small to medium sized, separate or gregarious, immersed in early stages, becoming widely erumpent or superficial, globose, collabent when dry; apex short papillate, ostiole periphysate; peridium externally brown, few rows of pseudoparenchymatous cells, internally compressed hyaline cells, surrounded by a thin coating or clumps of pallid to yellowish or grayish brown cells. Asci unitunicate, ellipsoid, numerous, forming in a hymenium, floating free, (1-7-)8-spored; apical ring refractive, chitinoid or nonchitinoid, nonamyloid, or not visible. Paraphyses lacking. Ascospores hyaline, often becoming light to dark brown, ellipsoid, fusoid, oblong or nearly allantoid, rarely subglobose, straight or curved, one-celled; wall thin, smooth, usually bearing terminal appendages; one or several guttules; overlapping in the ascus.

Anamorphs pycnidial, *Coniella* species.

Biotrophic causing blackened necrotic lesions on leaves and seedling blight or apparently saprobic on petioles and wood.

Type species: *S. straminea* C.L. Shear

MATERIALS AND METHODS

Herbarium material was rehydrated briefly in 3% KOH. Measurements of spores and conidia were made from water. Fluorescent microscopy was used on material mounted in calcofluor (0.5% w/v in sodium phosphate buffer at pH 8; Sigma Chemical Co.). Microscopic observations were made with interference contrast (IK), phase contrast (PC) and fluorescence (FLUOR). Herbarium abbreviations are taken from Holmgren *et al.* (**1990**).

KEY TO THE SPECIES OF SCHIZOPARME

1. Ascospores averaging greater than 7 μm wide; lignicolous or corticolous 2
1. Ascospores averaging less than 7 μm wide; foliicolous 3
2. Ascospores (22-)22.6-26.6(-27.5) x (16.2-)17-20(-21.2) μm ..... 2. *S. botrytidis*
2. Ascospores (13-)13.7-17.5(-20) x 7-9.4(-11.5) μm ..... 5. *S. stromatica*
3. Ascospores (6.5-)8.5-16(-17) x 2-3 μm ..... 1. *S. angustispora*
3. Ascospores greater than 3 μm wide 4
4. Ascospores (13.5-)15.4-19.8(-21.5) x (3-)3.5-4.5(-5.0) μm ..... 7. *S. versoniana*
4. Ascospores averaging less than 15 μm long 5
5. Ascospores (11-)11.5-13(-14.8) x (5-)5.4-7(-9) μm when discharged, becoming almost imperceptibly pale brown ..... 3. *S. destruens*
5. Ascospores averaging less than 5 μm wide 6
6. Perithecia remaining immersed, rupturing leaf epidermis by radial slits; ascospores remaining hyaline ..... 4. *S. straminea*
6. Perithecia at most basally immersed; ascospores distinctly brown in asci ..... 6. *S. terminaliae*

DESCRIPTIONS OF THE SPECIES

1. **Schizoparme angustispora** Samuels, M.E. Barr *et* Lowen, *sp. nov.* FIGS. 1-8.

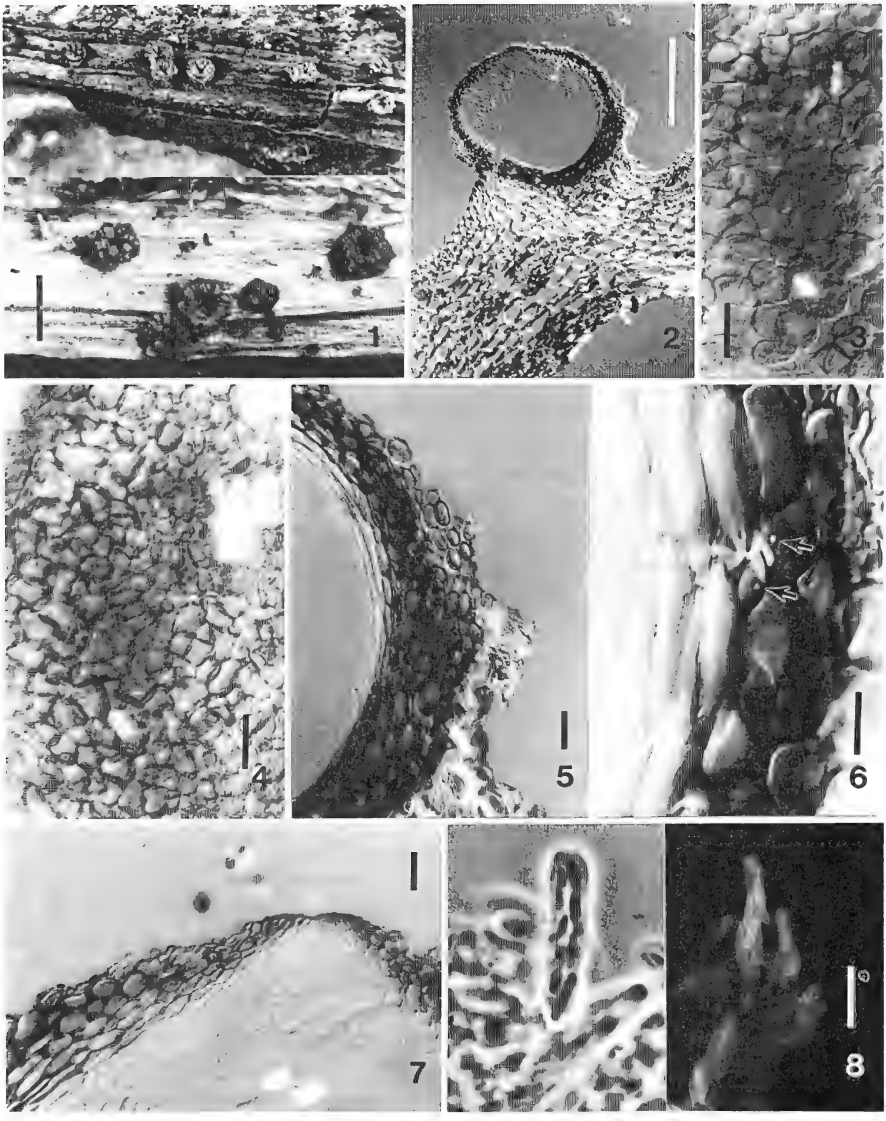
Characteris generis. Perithecia globosa, 350-500 μm diam. Asci angusti clavati, *ca* 25 x 5 μm, 8-spori, ad apicem annulo conspicuo provisi, basi acuti. Ascosporae cylindricae, oblongi-ellipticae, reniformes, allantoideae, (6.5-)8.5-16(-17) x 2-3 μm, hyalineae, magnitudine ut sporae in quoque asco variabiles.

Hab. in petioles of *Psidium guajava*.

HOLOTYPE: UNITED STATES. Hawaii: Kauai, Nualola Trail, near Kokee Lodge, on petioles of *Psidium guajava*, 22 Nov 1985, *S.E. Carpenter 45* (BPI).

Etymology: Refers to the narrow ascospores.

Anamorph: none known.



FIGS. 1-8. *Schizoparme angustispora*. 1. Habit of perithecia. 2. Off center section through a mature perithcium. 3. Small cells that form the perithecial

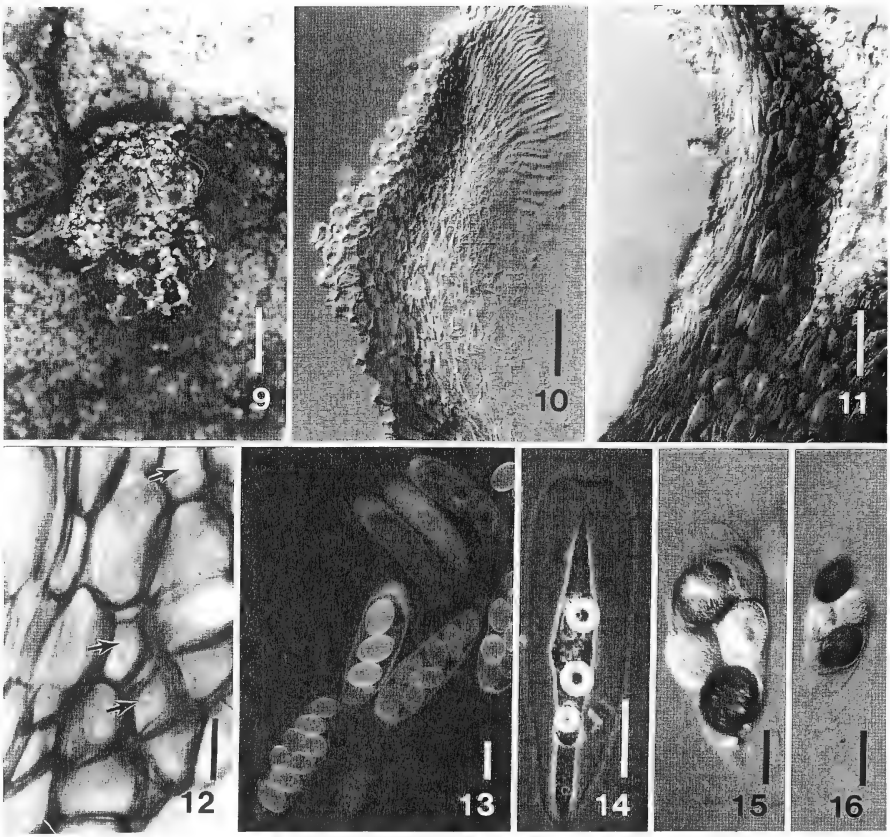
Perithecia forming on petioles, solitary to gregarious in groups of a few, erumpent and becoming nearly superficial with base immersed in petiole tissue, globose, 350-500 μm diam, apex short papillate, becoming deeply cupulate when dry, scaly to warted, brown to black with lighter brown scales and warts. Cells of warts circular, 10-15 μm diam, walls 1 μm thick, nonpigmented or lightly pigmented. Cells at surface of perithecial wall angular, 10-15 μm diam, walls ≤ 0.5 μm thick, brown. Perithecial wall, including warts, to 75 μm wide, comprising three intergrading regions; outer region consisting of 40 μm high warts; middle region *ca* 40 μm wide, of elliptic to angular cells 10-15 x 7-10 μm with walls 1 μm thick and brown, with minute pores; inner region of fusiform cells with walls 0.5-1 μm thick, nonpigmented. Perithecial apex of small circular cells with pigmented walls and continuous with the outer region of the perithecial wall; ostiolar canal periphysate, periphyses arising from a tissue continuous with the middle wall region. Asci narrowly clavate, *ca* 25 x 5 μm, not easily separating from each other in mass, 8-spored; thin-walled, apex simple; base not seen. Ascospores cylindrical, oblong-elliptical, reniform, allantoid, (6.5-)8.5-16(-17) x 2-3 μm, highly variable in size and often with spores of different sizes in asci, remaining hyaline.

HABITAT: On petioles of *Psidium guajava* L. (Myrtaceae).

KNOWN DISTRIBUTION: United States of America (Hawaii), known only from the type locality.

PARATYPE: UNITED STATES. Hawaii: Kauai, Kokee State Park, Awaawapuhi Trail, on petioles of undetermined plant, 21 Nov 1985, *S. E. Carpenter 31* (BPI).

<-warts. 4. Cells at the surface of the perithecial wall. 5. Longitudinal section of the perithecial wall. 6. Cells of lateral perithecial wall with pores (arrows). 7.Perithecial apex. 8. Asci (FLUOR right, PC left). All from *Carpenter 45* except 1, top which is *Carpenter 31*. Scale bars 1: top = 1 mm, bottom = 0.5 mm; 2 = 100 μm, 3-5,7,8 right; 6,8 left = 10 μm.



FIGS. 9-16, *Schizoparme botrytidis*. 9. Habit of perithecia. 10. Longitudinal section of a perithecium showing lateral wall and apex. 11. Longitudinal section of a lateral perithecial wall. 12. Cells of the lateral perithecial wall with pores (arrows). 13-16. Asci and ascospores. All taken from the type. 13 in FLUOR, 14 in PC, 15 and 16 in IK. Scale bars 9 = 1 mm, 10,11 = 25 μm; 12 = 10 μm; 13-16 = 20 μm.

2. **Schizoparme botrytidis** Samuels, M.E. Barr *et* Lowen, *sp. nov*. FIGS. 9-16.

Charactereis generis. Asci late clavati, 75-95 x 22-27 μm, 8-spori, ad apicem annulo conspicuo provisi, basi acuti. Ascosporae late ellipsoideae vel subglobosae, (22-)22.6-26.6(-27.5) x (16.2-)17-20(-21.2) μm, in asco inclusae atrobrunneae.

Hab. in arboris corticis.

HOLOTYPE: PUERTO RICO: Luquillo Mts., Luquillo Experimental Forest, El Verde, across trail at ridge above Río Sonadora, elev. *ca* 370 m, on bark of tree, Feb 1990, *D. J. Lodge 701* (BPI).

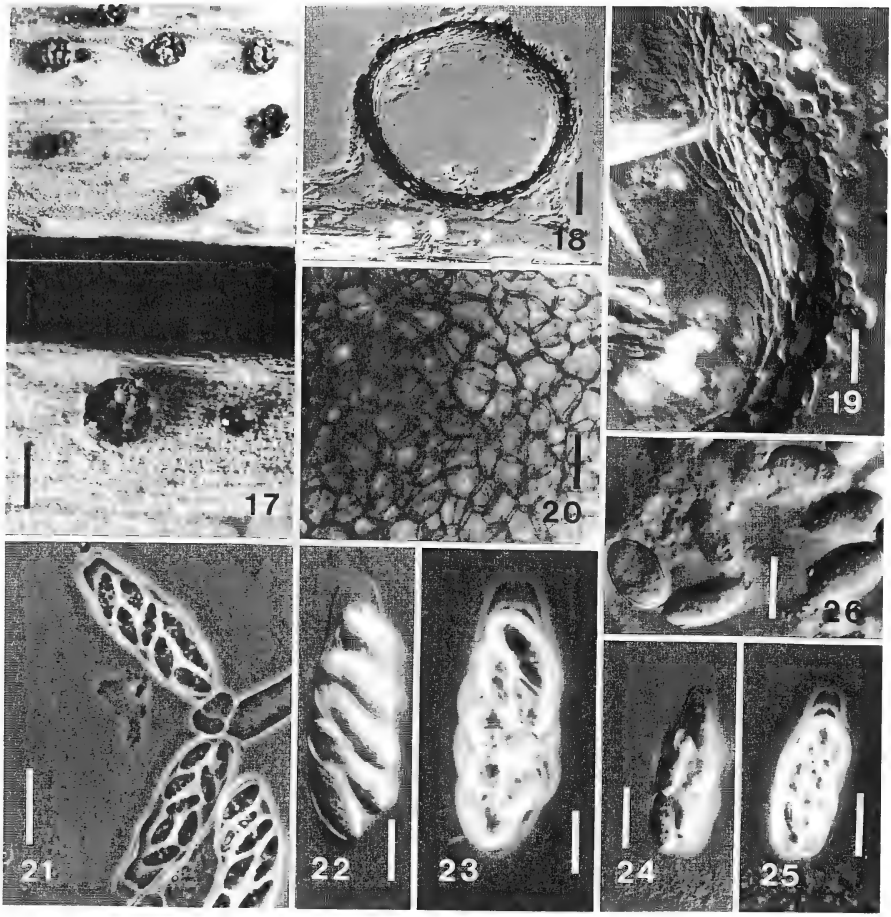
Etymology: Refers to the similarity of the perithecial aggregates to flowers of broccoli (*Brassica oleracea* var. *botrytis*).

Anamorph: none known.

Perithecia erumpent through bark, cespitose in tuberculate aggregates 1-2 mm diam x 1-2 mm high of up to 50 perithecia, subglobose, 500-700 μm high x 300-500 μm wide, apex short papillate, becoming deeply cupulate or not collapsing when dry, scaly to warted, black with pale greenish scales or warts. Cells at surface of perithecial wall angular, 15-25 μm diam, walls ≤ 0.5 μm thick, brown (KOH). Cells of warts circular, *ca* 10 μm diam, walls 0.5-2.5 μm thick, nonpigmented. Perithecial wall 50-75 μm wide, comprising three intergrading regions. Outer region formed by the warts; middle region *ca* 40 μm wide, of angular cells measuring 15-25 x 7-10 μm with walls *ca* 0.5 μm thick and brown, cells with minute pores in the walls; inner region 15-20 μm wide of flattened and compressed cells with thin, nonpigmented walls. Perithecial apex of small, *ca* 7 μm diam cells with walls 1-1.5 μm thick and nonpigmented in the external layers of cells but brown in the internal layers; ostiolar canal periphysate, periphyses arising from tissue continuous with the middle wall region. Asci broadly clavate, 75-95 x 22-27 μm, 8-spored; apex with a conspicuous ring; base pointed. Ascospores broadly ellipsoidal to subglobose, finally (22-)22.6-26.6(-27.5) x (16.2-)17-20(-21.2) μm when discharged, becoming opaque brown while still in asci.

HABITAT: On bark of undetermined tree.

KNOWN DISTRIBUTION: Puerto Rico, known only from the original collection.



FIGS. 17-26. *Schizoparme destruens*. 17. Habit of perithecia. 18. Off center section of a mature perithecium. 19. Longitudinal section of a perithecium showing lateral wall and apex. 20. Cells at surface of perithecial wall. 21-25. Asci and ascospores. 26. Ascospores. All from the isotype (BPI). 21, 23, 25 in PC, 22, 24 in IK. Scale bars 17: top = 0.5 mm, bottom = 0.25 mm; 18 = 50 μm; 19-21 = 20 μm; 22-25 = 10 μm.

3. **Schizoparme destruens** (M.E. Barr *et* Hodges) Samuels, M.E. Barr *et* Lowen, *comb. nov*. FIGS. 17-26.

Gnomoniella destruens M.E. Barr *et* Hodges, Mycologia 79: 782. 1987.

HOLOTYPE: UNITED STATES OF AMERICA: Hawaii: Hilo, on *Eucalyptus globulus*, 16 Oct 1981, *C. S. Hodges s.n.* (NY, ISOTYPE BPI 596643).

Anamorph: none known.

Perithecia forming on twigs, solitary to gregarious, erumpent becoming nearly superficial with base immersed in twigs, globose, 150-400 μm diam, apex short papillate, becoming deeply cupulate when dry, scaly to warted, dark brown becoming black in age, with tan to yellowish scales or warts. Cells at surface of perithecial wall and warts circular to angular, *ca* 12 μm diam, wall 0.5-1 μm thick. Perithecial wall 25-40 μm wide, comprising three intergrading regions; outer region, including 15 μm high warts, of a few layers of circular, 7-9 μm diam cells with walls 1.5 μm thick and nonpigmented; middle region 15-25 μm wide, of 3-5 layers of pseudoparenchymatic cells measuring 15-25 x 7.5-10 μm, walls < 0.5 μm thick, pigmented, with minute pores in walls; inner region *ca* 15 μm wide, cells fusoid, *ca* 25 μm long, 7.5 μm wide, walls 0.5-1 μm thick, nonpigmented. Perithecial apex of small, circular cells with pigmented walls and built up as warts at the exteriors; ostiolar canal periphysate, periphyses arising from tissue continuous with the inner wall region. Asci clavate, 36-41.8(-45) x (10-)11.4-14(-15) μm, 8-spored, apex with an inconspicuous ring, base rounded. Ascospores ellipsoidal, (11-)11.5-13(-14.8) x (5-)5.4-7(-9) μm when discharged, becoming almost imperceptibly pale brown.

HABITAT: On twigs of *Eucalyptus globulus* Labill. (Myrtaceae).

KNOWN DISTRIBUTION: USA (Hawaii), known only from the type collection.

NOTES: *Schizoparme destruens* is very similar to *S. terminaliae*. Ascospores of *S. destruens* are broader than those of *S. terminaliae*, and the apical ring of the former species is much less conspicuous than that of the latter. Further, *S.*

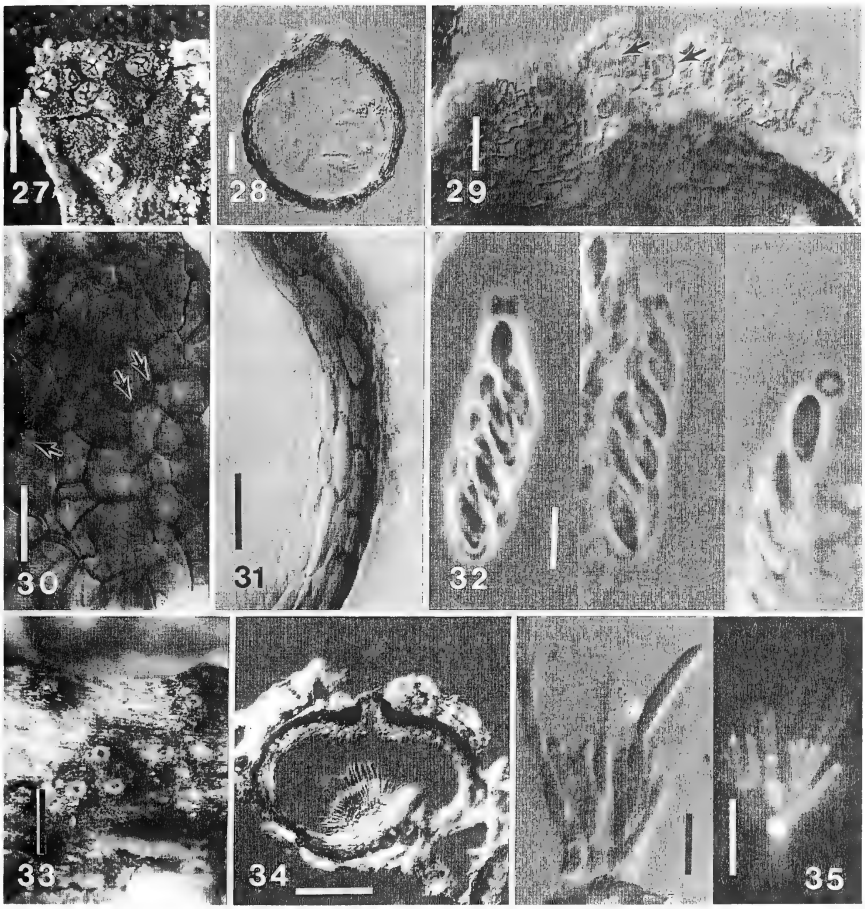
destruens occurs on twigs of *Eucalyptus globulus* but apparently not on leaves whereas perithecia of *E. terminaliae* occur only on leaves of the unrelated *Terminalia superba*. As far as is known, the ranges of the two fungi are quite distinct, Hawaii and Ecuador, respectively.

4. *Schizoparme straminea* Shear, Mycologia 15: 121. 1923. FIGS. 27-36.

HOLOTYPE: USA. VIRGINIA: Arlington Farm, on *Rosa rugosa prostrata*, 6 Sep 1920, *C.L. Shear 3568* (BPI).

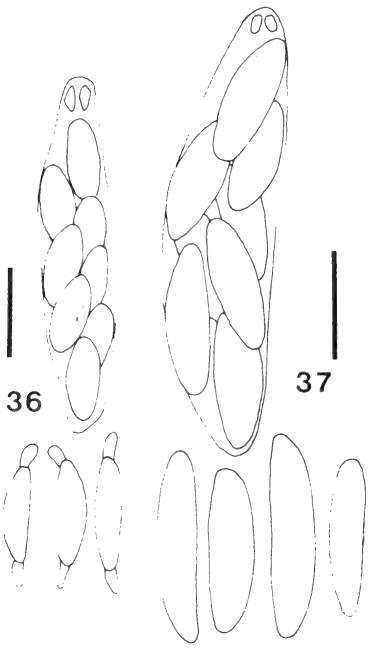
Anamorph: *Coniella castaneicola* (Ellis et Everh.) Sutton, The Coelomycetes, p. 420. 1980. FIGS. 33-35.
Gloeosporium castaneicola Ell. et Everh., Proc. Acad. Nat. Sci. Philadelphia 1895: 435. 1895.

Perithecia numerous on abaxial leaf surface, immersed and rupturing the leaf epidermis by four radial slits and becoming broadly erumpent, globose with a minute, acute central papilla, 200-300 μm diam, with 3-4 coarse tan warts, cupulate when dry. Cells at surface of perithecial wall angular, thin-walled, with minute pores. Perithecial wall *ca* 15 μm wide laterally comprising a single region of 2-3 layers of elliptic to fusiform cells measuring 10-15 μm long, 4-5 μm wide, wall 1-1.5 μm thick, brown. Perithecial apex of small, brown cells, ostiolar canal periphysate. Warts formed around the perithecial apex of circular, *ca* 15 μm diam cells with walls *ca* 1.5 μm thick and nonpigmented; easily disloged from the perithecial surface. Paraphyses not observed. Asci clavate, 30-40 x 7-9 μm, apex with a conspicuous refractive ring, sessile, floating free, 8-spored; ascospores biseriate, forming a hymenium lining the perithecial locule. Ascospores ellipsoidal to inequilateral with one flat side, 10-13 x 3-4 μm, unicellular, hyaline, with a hyaline, acute, 3 μm long appendage sometimes seen at each end of some ascospores still in asci.



FIGS. 27-35. *Schizoparme straminea*. 27. Habit of perithecia. 28. Off center section of a mature perithecium. 29. Perithecial apex with small, pale cells of the warts (arrow). 30. Cells at surface of perithecial wall with pores (arrows). 31. Longitudinal section of the lateral perithecial wall. 32. Three asci, on the right seen from above and showing the full ring. 33. Habit of pycnidia. 34. Median longitudinal section of a pycnidium. 35. Conidiophores and conidiogenous cells. All from BPI 600008 except 27 which is from the type. 32 in PC, 35 left in cotton blue-IK, 35 right in FLUOR. Scale bars 27,33 = 0.25 mm; 28,34 = 50 μm; 29-31,35 right= 20 μm; 32,35 left = 10 μm.

Anamorph in nature: Conidiomata pycnidial, immersed, globose to subglobose 140-150 μm diam, black; opening by a central pore, ostiolar opening surrounded by stromatic tissue oftan cells. Conidiophores not observed. Conidiogenous cells developing from a hemispherical cushion of cells at pycnidial base, cylindrical, 10 x 3 μm diam, phialidic. Conidia 15-29 x 2.5-3.5 μm, fusiform or falcate, pale brown (Sutton, **1980**).



HABITAT: On decaying leaves of at least eleven unrelated genera of dicotyledonous plants (Sutton,**1980**).

KNOWN DISTRIBUTION: Cosmopolitan.

ADDITIONAL SPECIMEN EXAMINED: USA. MARYLAND: Bell, on *Castanea* sp., 7 Oct 1920, *B. O. Dodge* (BPI 600008).

NOTES: The *Coniella* anamorph of *S. straminea* has been well described and illustrated by Shear (**1923**, Pl. 13, Fig. 2) and Maas et al. (**1979**). See Sutton (**1980**) for extensive anamorph synonymy.

FIGS. 36, 37. Asci and ascospores of *Schizoparme* species. 36. *Schizoparme straminea*, ascus and ascospores with appendages (BPI 600008). 37. *S. versoniana*, ascus and ascospores (type). Scale bars = 10 μm.

5. *Schizoparme stromatica* Samuels, M.E. Barr et Lowen, *sp. nov.* FIGS. 38-47.

Charactereis generis. Perithecia globosa, 400-450 μm diam. Asci naviculares, 65-80 x 11-16 μm, 8-spori, ad apicem canali

longo provi; basi acuti. Ascosporae anguste vel late ellipsoideae, (13-)13.7-17.5(-20) x 7-9.4(-11.5) μm, atrobrunneae.

Hab. in arboris corticis.

HOLOTYPE: BRAZIL. Pará: vic. Belém, Ilha do Combu, Estacão Experimental Combu, 01°30'S, 48°27'W, elev 0 m, on bark, Jan 1989, *G. J. Samuels 6215 & K. F. Rodrigues* (MG, ISOTYPES BPI, NY).

Etymology: Refers to the stromatic perithecia.

Anamorph: *? Coniella* sp.

Perithecia erumpent through bark, solitary or in scattered, stromatic, tuberculate aggregates of up to five, globose, 400-450 μm diam, apex short papillate, becoming deeply cupulate when dry, warted, dark brown to black with lighter brown warts. Cells at surface of perithecial wall angular, 10-15 μm diam, walls 1 μm thick, pigmented. Cells of warts circular, 7-10 μm diam, wall 1.5 μm thick, nonpigmented. Perithecial wall, including warts, to 50 μm wide, comprising three intergrading regions; outer region consisting of 20-25 μm high warts; middle region 20-25 μm wide, of angular cells 10-15 x 5-7 μm with walls 1-1.5 μm thick and brown; inner region 10-15 μm wide of flattened compressed cells with thin, nonpigmented walls. Perithecial apex of small nearly circular cells with nonpigmented walls; ostiolar canal periphysate, periphyses arising from a tissue continuous with the middle wall region. Stroma composed of angular cells with brown walls, continuous with the outer region of the perithecial wall. Asci navicular, 65-80 x 11-16 μm, 8-spored; apex with a long channel, no ring seen; base pointed. Ascospores narrowly to broadly ellipsoidal, (13-)13.7-17.5(-20) x 7-9.4(-11.5) μm, becoming dark brown.

CHARACTERISTICS IN CULTURE: Colonies grown on cornmeal dextrose agar (CMD: Difco cornmeal agar + 2% dextrose) at 20 C for 5 days under diffuse daylight 5 cm diam, transparent, white, with no aerial mycelium, sterile; pycnidia forming within one month on CMD at 20 C under 12 h darkness/12 h cool white fluorescent light. Pycnidia numerous, discrete, nonstromatic, superficial but with base remaining immersed, forming throughout the colony, conical to pulvinate,

250-500 wide x 350 μm high, opening through the apex; wall pseudoparenchymatous, cells angular, *ca* 7 μm diam. Conidiophores lacking. Conidiogenous cells forming from a central pad of pseudoparenchymatic cells in the base of the pycnidium, cylindrical, 10-15 x 3.5 μm, monoblastic; conidiogenous locus terminal, proliferating percurrently with a few widely spaced annellations visible. Conidia broadly ellipsoidal, (10.5-) 12.4-19.7(-21.7) x (7-)8-10(-10.5) μm, with a protuberant, flat, 1.5 μm wide basal abscission scar or truncate, unicellular, brown with a longitudinally oriented clear slit-like area, smooth. Paraphyses lacking.

HABITAT: On bark of unidentified tree.

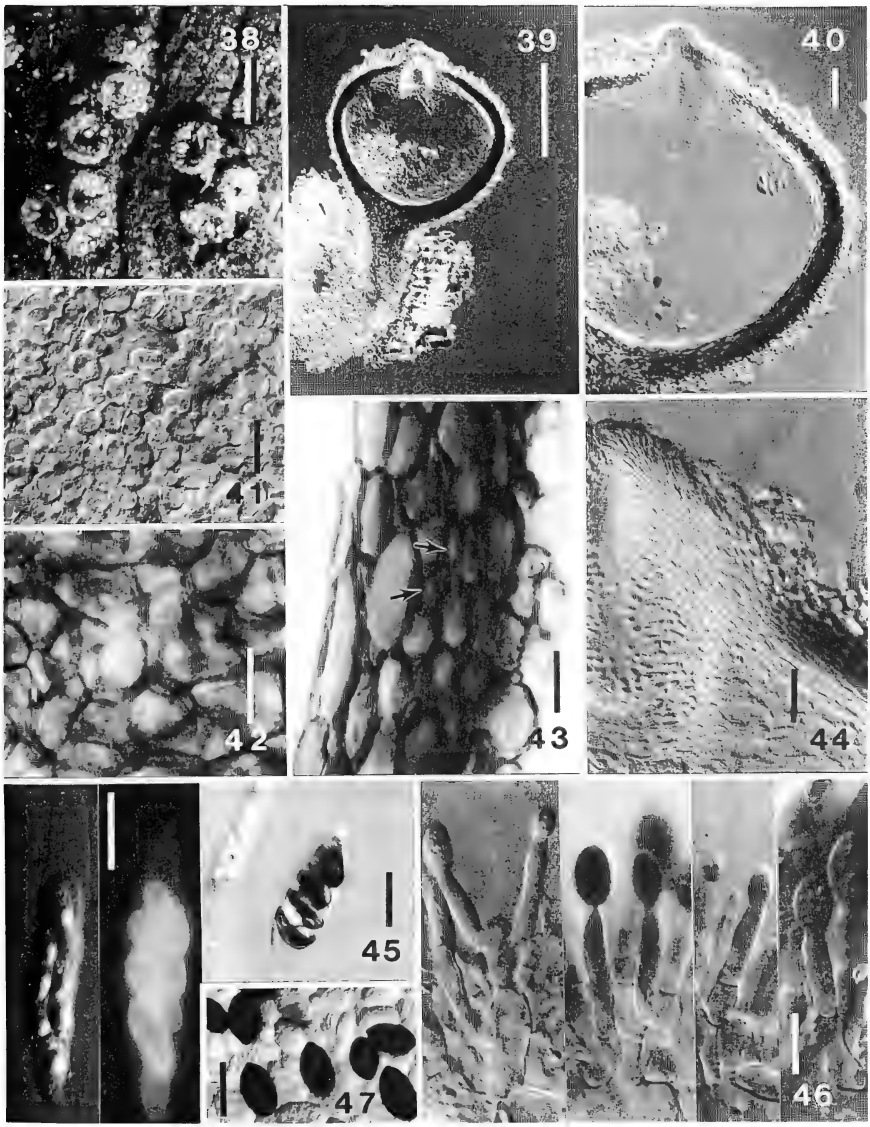
KNOWN DISTRIBUTION: Brazil (Pará), known only from the type collection.

NOTES: Ascospores germinated in high percentage within eight hours on CMD by producing very long, unbranched, robust germ tubes. Unfortunately, the cultures are no longer viable. Dry cultures are preserved with the isotype specimen in NY. No comparable anamorph was found on the specimen.

In the absence of naturally formed pycnidia it is not possible to satisfactorily place this anamorph. The closest morphological comparison that we can make is with *Melanconium* (Sutton, **1964**; Morgan-Jones, **1977**), *Melanconiopsis* (Nag Raj and DiCosmo, 1978; Sutton, **1980**), or *Coniella* Höhnel (Morgan-Jones *et al.*, **1972**; Sutton, **1969**). Conidiomata of species of *Melanconium* and *Melanconiopsis* are acervular and open widely; the conidiogenous cells form in a hymenium. The conidioma of species of *Coniella* is pycnidial and opens by a restricted, albeit irregular, opening; conidia arise from a basal, pseudoparenchymatous area. Conidiophores are lacking in all three genera. Conidiogenous

---

-> FIGS. 38-47. *Schizoparme stromatica*. 38. Habit of perithecia. 39, 40. Median longitudinal sections of mature perithecia. 41. Cells of perithecial warts. 42. Cells at surface of perithcial wall. 43. Cells of lateral perithecial wall with pores (arrow). 44. Perithecial apex. 45. Three asci; pigmented spores in ascus on right. 46. Conidiogenous cells with developing conidia. 47.



Conidia. All from the type. 45 left and right in IK, middle in FLUOR. 46 in IK. Scale bars 38 = 0.5 mm μm; 39 = 200 μm, 40 = 50 μm, 41,42,44,45,47 = 20 μm; 46 = 10 μm.

cells in *Melanconium* and *Melanconiopsis* proliferate percurrently and have a few annellations whereas the conidiogenous cells in *Coniella* have distinct periclinal thickening (Sutton, **1980**) and lack annellations. Species of all three of these genera have rather large, elliptical, dark brown conidia. A clear, longitudinally oriented, slit-like region is visible in conidia of *C. fragariae* (Oud.) Sutton (Sutton, **1980** Fig. 252H); no such clearing has been attributed to species of *Melanconis* or *Melanconiopsis*. The conidial base in species of *Melanconis* is described as being truncate (Morgan-Jones, **1977**; Sutton, **1964**), but can be truncate or papillate in *Melanconiopsis* (Nag Raj & DiCosmo, **1978**; Sutton, **1980**) or *Coniella* (Sutton, **1980**).

We cannot choose from among *Coniella*, *Melanconiopsis*, and *Melanconium* for the anamorph of *Schizoparme stromatica*. However, both *Melanconiopsis* and *Melanconium* have been linked to *Melanconis* L.-R. *et* C. Tulasne, which is a genus of the Melanconidaceae Winter in Rabenhorst in the Diaporthales.

6. **Schizoparme terminaliae** Samuels, M.E. Barr *et* Lowen, *sp. nov.* FIGS. 48-54.

Characteries generis. Perithecia globosa, 300-360 μm diam. Asci clavati, (30-)31.6-37.9(-45) x (6-)7.4-9.2(-10) μm, 8-spori; ad apicem annulo conspicuo provisi; basim acuti. Ascosporae anguste vel late ellipsoideae, ejectae (10-)11.3-13.9(-15) x (3-)3.5-5.7(-6) μm, brunneae.

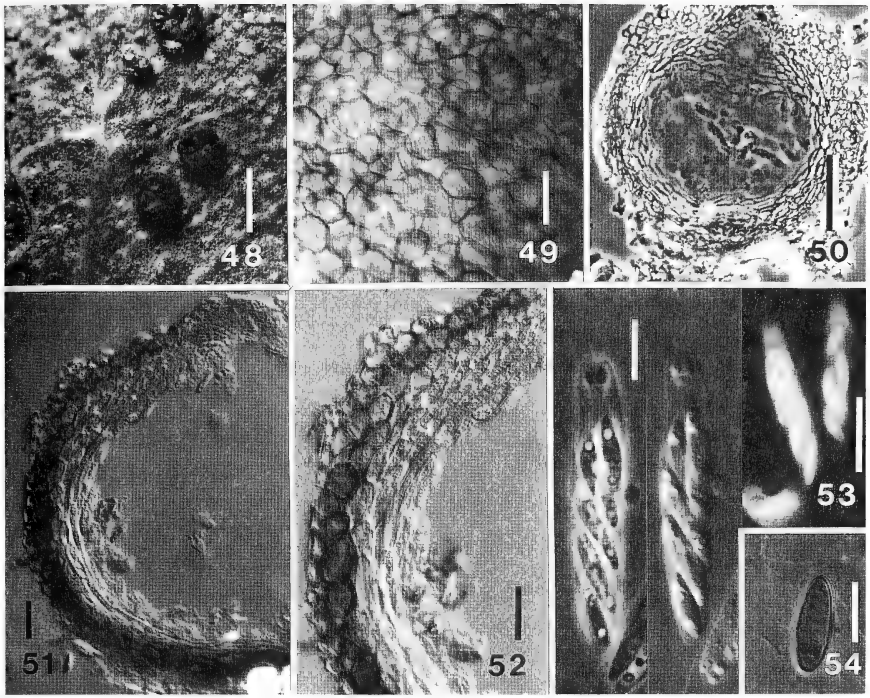
Hab. in foliis *Terminaliae superbae* Engl. *et* Diels

HOLOTYPE: ECUADOR: Río Silanche, on leaves of *Terminalia superba*, 18 Jul 1991, *C. S. Hodges s.n.* (BPI).

Etymology: Refers to the host plant.

Anamorph: none known.

Perithecia forming toward tip of abaxial leaf surface between veins, solitary to gregarious, erumpent becoming nearly superficial with base remaining immersed in leaf tissue, globose, 300-360 μm diam, apex short papillate, becoming



FIGS. 48-54. *Schizoparme terminaliae*. 48. Habit of perithecia. 49. Cells at surface of perithecial wall. 50. Median longitudinal section through an immature perithecium. 51. Median longitudinal section through a mature perithecium. 52. Lateral perithecial wall. 53. Three asci. 54. Mature ascospore. All from the type. 53, left, in PC; middle in IK; right in FLUOR. Scale bars 48 = 0.5 mm, 49 = 51-53 right = 20 μm, 53 left two asci, 54 = 10μm.

deeply cupulate when dry, scaly to warted, brown becoming black in age, with lighter scales or warts. Cells at surface of perithecial wall and warts nearly circular, 10-15 μm diam, wall < 1 μm thick. Perithecial wall 25-40 μm wide, comprising three intergrading regions; outer region variable, in part missing or

limited to one or two layers of cells and in part present as warts measuring to 50 μm high, cells circular, *ca* 7.5 μm diam, walls 1-1.5 μm thick, nonpigmented; middle region *ca* 25 μm wide, of 2-3 layers of pseudoparenchymatous cells measuring 7-12 x *ca* 5 μm with walls pigmented brown, minute pores visible in walls of many cells; inner region 20-25 μm wide, cells fusiform, 12-20 x 5-7 μm, walls 1-1.5 μm thick, nonpigmented. Perithecial apex of small, circular cells with nonpigmented cells at the exterior and pigmented cells at the interior; ostiolar canal periphysate, periphyses arising from tissue continuous with the inner wall region. Asci clavate, (30-)31.6-37.9(-45) x (6-)7.4-9.2(-10) μm, 8-spored; apex with a prominent ring measuring 3 μm long x 3 μm diam; base pointed. Ascospores narrowly to broadly ellipsoidal, enlarging in asci, finally (10-)11.3-13.9(-15) x (3-)3.5-5.7(-6) μm when discharged, becoming distinctly brown while still in asci.

HABITAT: On leaves of *Terminalia superba* (Combretaceae).

KNOWN DISTRIBUTION: Ecuador, known only from the type collection.

7. **Schizoparme versoniana** (Sacc. *et* Penzig) Nag Raj *et* Lowen, *comb. nov.* FIG. 37.

Nectriella versoniana Sacc. *et* Penzig, Michelia **2**: 256. 1881.

HOLOTYPE: SPAIN. Granada, Torreglia, Euganei, in immature, rotting fruits of *Punicia granatum* Sokotra [as "*granati*"], associated with *Phoma versoniana* Sacc., in viridarium, Nov 1880, *Penzig et Verson, Mycoth. Veneta 1484* (PAD!; ISOTYPES: BPI!, K!, NY!).

Anamorph: *Coniella granati* (Sacc.) Petrak *et* H. Sydow, Repert. Spec. Nov. Regni Veg. Beih. 42: 461. 1927.

Phoma granati Sacc., Nuovo Giorn. Ital. 8: 200. 1876.

Perithecia subglobose, 280-440 μm diam, erumpent, becoming superficial with bases immersed in substrate, solitary to gregarious, nonpapillate, cupulate and black when

dry, becoming brown and releasing yellow-brown pigment in KOH. Cells at surface of perithecial wall angular *textura epidermoidea*, to 16 μm diam; walls 1.5-2.0 μm thick. Perithecial wall *ca* 15 μm wide. Paraphyses not observed. Asci clavate, 45-60 x 8-11 μm, containing a large apical ring; sessile, ascospores biseriate. Ascospores ellipsoidal, (12-)15.5-19.8(-20) x (3-)3.5-4.5(-5) μm, unicellular, smooth, surrounded by hyaline sheath; a small, rounded appendage at each end of some spores.

Anamorph in nature: Conidiomata pycnidial, similar in shape to teleomorph but smaller, 70-160 μm high x 120-210 μm wide, black; collapsing vertically, becoming deeply cupulate. Surface cells angular, 8-10 μm diam. Conidiogenous cells phialidic; developing on a lenticular cushion of cells in the base of the pycnidium. Conidia irregularly ellipsoid, 9-16(-21) x 3.0-4.5 μm, unicellular, pale brown, inconspicuous slit sometimes observed.

ADDITIONAL SPECIMEN EXAMINED: CYPRUS. Roselle, on fruit of *Punicia granatum*, 1961, *N. A. Burges* (IMI, culture collection 90 700).

NOTES: The type collection of *Nectriella versoniana* has only few, old perithecia. Warts, as are seen in other species of *Schizoparme*, could not be seen at the surface of the perithecium. However, the general aspect of the virtually superficial perithecia, clavate diaporthaceous asci, unicellular ascospores, and *Coniella* anamorph leave no doubt that this is a species of *Schizoparme*.

ACKNOWLEDGMENTS

We appreciate the loan of material from K and PAD. We are indebted to Drs. S.E. Carpenter, C.S. Hodges, Jr., and D.J. Lodge for providing us with collections of *Schizoparme* species. Dr. T.R. Nag Raj shared his thoughts about *Coniella* with us. Carpenter's field work in Hawaii was supported by NSF grant BSR-8500434. Samuels' field work in Brazil was supported by NSF BSR-8721877. Dr. Rupert Barneby (NY) corrected the Latin diagnoses.

LITERATURE CITED

Barr, M. E. 1970. Some amerosporous ascomycetes on Ericaceae and Empetraceae. *Mycologia* **62**: 377-394.

_____. 1990. Prodromus to nonlichenized, pyrenomycetous members of class Hymenoascomycetes. *Mycotaxon* **39**: 43-184.

_____, **and C. S. Hodges, Jr.** 1987. Hawaiian forest fungi. VIII. New species in *Gnomoniella* and *Stigmochora*. *Mycologia* **79**: 782-786.

Clements, F. E., and C. L. Shear. 1931. *The Genera of Fungi.* H. W. Wilson Co., New York. 496 p. + 58 pl.

Dodge, B. O. 1936. *Schizoparme straminea* and *Nectriella versoniana* identical. *Mycologia* **28**: 95-98.

Eriksson O. E., and D. L. Hawksworth. 1987. Outline of the Ascomycetes-1987. *Syst. Ascom.* **6**: 260-338.

Holmgren, P. K., N. H. Holmgren, and L. C. Barnett. 1990. Index Herbariorum Part I: The herbaria of the world. *Regnum Vegetabile* **120:** 1-693.

Jensen, J. D. 1985. Peridial anatomy and pyrenomycete taxonomy. *Mycologia* 77: 688-701.

Lowen, R. 1991. *A monograph of the genera* Nectriella *Nitschke and* Pronectria *Clements with reference to* Charonectria, Cryptonectriella, Hydronectria *and* Pseudonectria. Unpublished Ph. D. thesis, City University of New York, New York. 331 p.

Maas, J. L., F. G. Pollack, and F. A. Uecker. 1979. Morphology and development of *Pilidiella quercicola*. *Mycologia* **71**: 92-102.

Morgan-Jones, G. T. R. Nag Raj, and B. Kendrick. 1972. Icones genera coelomycetarum II. *Univ. Waterloo Biol. Ser.* **4**: 1-41.

_____. 1977. Icones generum coelomycetum IX. *Univ. Waterloo Biol. Ser.* **17:** 1-43.

Nag Raj, T. R., and F. DiCosmo. 1978. Icones generum coelomycetum X. *Univ. Waterloo Biol. Ser.* **19**: 1-46.

Rogerson, C. T. 1970. The hypocrealean fungi (Ascomycetes, Hypocreales). *Mycologia 62*: 865-910.

Shear, C. L. 1923. Life histories and undescribed genera and species of fungi. *Mycologia* **15**: 120-131 + Pls. 12, 13.

Sutton, B. C. 1964. *Melanconium* Link ex Fries. *Persoonia* **3**: 193-198.

_____. 1969. Type studies of *Coniella*, *Anthasthoopa*, and *Cyclodomella*. *Can. J. Bot.* **47**: 603-608.

_____. 1980. *The Coelomycetes*. Commonwealth Mycological Institute, Kew, Surrey, England. 696 p.

MYCOTAXON

Volume XLVI, pp. 485-489 January-March 1993

BOOK REVIEWS

L. M. Kohn, Book Review Editor

The Fungal Community, 2nd Edition, G. C. Carroll and D. T. Wicklow (Eds.). Hardcover, 260 x 181 mm, 976 pp. 1992. Marcel Dekker, Inc., New York (tel (U.S.): 1-800-228-1160; tel (Basel): 061-261-8482; fax (U.S.): 914-796-1772). ISBN 0-8247-8605-X. U.S. $225.--.

The first edition of **The Fungal Community**, D. T. Wicklow and G. C. Carroll (Eds.) attempted to verify the roles of fungi in ecology by concentrating a plethora of information into a single volume. Now, eleven years later, the second edition of **The Fungal Community** heralds a new era of fungal biology by highlighting the role that fungi have in nearly every aspect of ecology and providing modern inroads to their study.

For those who have used the first edition, the second edition is over 100 pages and three chapters longer, includes new sections on Fungal Influences on Plant Community Dynamics and on Mycological Systems for Examining Ecological Communities, and eliminates the section on Aquatic Hyphomycete Communities. Approximately 20% of the authors of the second edition contributed chapters to the first edition. Among the new contributors are many dynamic figures well known to ecology, mycorrhizal studies, and fungal biology. Several chapters are, in effect, updated versions of chapters from the first edition. The presentation of information is much improved in the second edition because of the more easily read font style and high quality photographic plates and graphics.

For those who are not familiar with the first edition, sections of the second edition are organized in more or less hierarchical fashion beginning with Fungal Ecology and Ecological Theory, followed by Fungal Populations, Environmental Parameters, and the Niche Concept, The Organization of Fungal Populations and Communities, Species Interactions in Fungal Communities, Fungal Community Development, Fungal Biomass and Productivity in Ecosystems, Fungi in Nutrient Cycling, in addition to the two aforementioned new sections. A concerted effort has been made to include information derived from modern molecular techniques in such well written chapters as Genetic Mechanisms in Fungal Adaptation, Analysis of Fungal Population Structure Using Molecular Techniques, and Fitness of Genetically Altered Fungi. Also to the editors' credit, an effort has been made to place the fungi in a general ecological context with chapters entitled

Mycorrhizae and Plant Community Development: Mechanisms and Patterns, Fungal Pathogens and the Structure of Plant Populations and Communities, Plant Pathogens and Long-Term Ecosystem Changes, Interactions Between Invertebrates and Fungi: Effects of Nutrient Availability, Anaerobic Fungi and the Rumen Ecosystem, and Interactions Between Fungi and Nitrogen-Fixing Bacteria. There are also helpful chapters on Multivariate Analysis in Fungal Ecology, and Estimating Fungal Biomass and Productivity in Decomposing Litter that point out problems with the techniques that they describe and their biological relevance.

Special mention should be made of the chapters updated from the first edition. How often does one get the opportunity to revise a manuscript published over ten years earlier? Even though the titles of most of these chapters remain unchanged and the organization follows closely that of the previous edition, the content of each chapter advances the science and provides additional information derived from eleven years of progress and feedback.

The chapter by D. J. Read entitled The Mycorrhizal Fungal Community with Special Reference to Nutrient Mobilization is closest to my own research interests. This chapter provides a thorough summation of exciting issues being developed in mycorrhiza science today along with selected data which exemplify key points. Generalizations regarding the state of current knowledge and the identification of critical future research needs are highly appropriate. However, this chapter offers little new information that has not been covered previously in a host of recent similar reviews by the author. In addition, as in the other reviews, the literature cited draws too heavily on publications derived from the author's laboratory and in several instances leaves out reference to important research being conducted in North America and elsewhere.

One of the highlights in the second edition is the Introduction by A. D. M. Rayner, a detailed chapter by chapter overview of the strong and weak points of key chapters. Although not a contributed chapter *per se*, this introduction provides a critical synopsis of elements currently in the forefront of fungal ecology and provides a stimulus to read and ponder the text.

Brimming with current references, this volume is a useful resource. Anyone interested in ecology, forestry, mycorrhizae, plant pathology or fungi and fungal processes in general will find a great deal of readily available information. This edition will undoubtedly act as a springboard for innovative investigations into fungal ecology in the next decade, just as the first edition did eleven years ago. *S. L. Miller, Botany Dept., Univ. of Wyoming, Laramie WY 92071*

Authors of Fungal Names, Index of Fungi Supplement, compiled by P. M. Kirk and A. E. Ansell. Softcover, 246 x 150 mm, 95 pp., 1992. CAB International, Wallingford, Oxon OX10 8DE, UK [fax: (0491) 33508], US Agents: Univ. of Arizona Press, 1230 North Park Ave., Suite 102, Tucson, AZ 85719-4140 U.S.A. (fax: 602-621-8899). ISSN 0019-3895. ISBN 0-85198-833-4.

Subtitled "A list of authors of scientific names of fungi, with recommended standard forms of their names, including abbreviations," this useful booklet lists 9288 names of authors of fungi abbreviated strictly following several principles outlined in the Introduction. These principles are those applied in Brummitt and Powell's 1992 **Authors of Plant Names** (Royal Botanical Gardens, Kew). The most important of these are the application of only one standard form to each author, uniform treatment of names, and rules for full stops and treatment of accents. Principles for when and how to abbreviate names are also provided in the Introduction. Authors are listed alphabetically by surnames in Roman characters only. Alternative spellings that may result from use of more than one name by an author or from transliteration, e.g., from Chinese or Cyrillic, are indicated by cross reference with round brackets, with the accepted forms clearly indicated. Years of birth and death, where they could be ascertained, are also provided for each entry. This reader (and author of fungal names) was taken aback to find birth dates included for living authors as well. An indispensable desk reference that will stabilize application of abbreviations to authors of fungal names in the taxonomic literature to come. *L.M.K.*

Sustainable Practices for Plant Disease Management in Traditional Farming Systems, by H. D. Thurston. Hardcover, 235 x 155 mm, 279 pp., 1992. Westview Press, 5500 Central Ave., Boulder, Colorado 80301-2847 U.S.A. (fax: 303-449-3356), and 36 Lonsdale Road, Summertown, Oxford OX2 7EW, U.K; in India, Oxford & IBH Publishing Co. Pvt. Ltd., 66 Janpath, New Delhi 110 001. ISBN 0-8133-8363-3 and in India ISBN 81-204-0653-2. U.S. $32.50.

This book, the result of a lifetime of study, offers an overview and entry to the literature on the approaches of traditional farmers to plant disease management. "Traditional" is taken both in the historical sense, e. g., from ancient mediterranean, middle eastern, and new world cultures, and in the sense of practices still used by farmers in the developing world that have been developed over time through shrewd observation and use of existing resources. "Management" rather than "control" of disease is also stressed. Sections treat Application of Chemicals, Biological Control, Cultural Practices (Planting, Land Preparation, Crop Manipulations) and Host Plant Resistance. This book succinctly treats the major principles of agricultural practice, including "hot button" issues in both the developed and the developing world, for

example, land management, responsible use of chemical controls, biocontrol alternatives such as antagonistic plants and trap crops, tillage and no-tillage systems, monoculture and multiple cropping, and biodiversity and conservation of genetic resources. Why study traditional practices? In the author's own words, "The study of traditional management of plant diseases should be a rewarding area for future plant pathologists who are not completely seduced by the terms 'new' and 'innovative' and the prestigious and intellectually appealing basic research in biotechnology. If the 10,000 years of farming experience embodied in traditional agriculture and the knowledge of indigenous peoples can be combined with modern agricultural science, perhaps more sustainable, environmentally sound, and useful agriculture will result. The book is written for those interested in improving agriculture and the environment." Mycologists interested in plant disease management, plant pathologists and agronomists, resource and agricultural planners, and teachers wishing to introduce traditional agricultural practices to their university students will want to read this book. *L.M.K.*

Ascomyceten auf Gefäßpflanzen an Ufern von Gebirgsseen in den Ostalpen, by M. Magnes and J. Hafellner. Bibliotheca Mycologia, Band 139. Softcover, 225 x 140 mm, 182 pp. + figs., 1991. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Johannesstr. 3 A, D-7000 Stuttgart 1, Germany [fax: (0711) 625005]; U.S. Agent, Lubrecht & Cramer, R.D. 1, Box 244, Forestburgh, NY 12777 (fax: 914-791-7575). ISBN 3-443-59040-3. DM 80.-- .

Fifty-two ascomycetous taxa, including two new species (*Massarina amphibia*, *Pyrenopeziza huetteri)* and two new combinations (*Nectriella lacustris*, *Micropeltopsis nigro-annulata* var. *papillosa*), were identified from vascular plants growing on the shores of mountain lakes in the Eastern Alps. Each taxon is described and illustrated. Other species growing on the same substrates reported from the literature are incorporated in the keys provided. Seven species are reported as occurring on both *Carex rostrata* and *Equisetum fluviatile*, and this unusual combination of substrates is discussed. Endophytes are not treated. Of interest to arctic-alpine mycologists and taxonomists following a range of ascomycetous taxa. *L.M.K.*

Untersuchungen zu Fortpflanzung und Ploidie vershiedener Ascomyceten, by E. Weber. Bibiotheca Mycologia, Band 140. Softcover, 225 x 140 mm, 186 pp., 1992. J. Cramer (see previous title). ISBN 3-443-59041-1. DM 90.--.

This publication reports several lines of research on ascomycetous life cycles. New data on breeding relationships within 33 species of the Leotiales and Pezizales, as well as measurements of relative DNA content in several representative species through the life cycle are

reported. The big issue will be the data on relative DNA content as determined by fluorometry of 566 species, mainly of the Leotiales and Pezizales but including some other groups, such as the Endomycetales. The report that most of these taxa are polyploid will be surprising to some workers who have conducted genetic studies on some of these species; these results should be verified using alternative methods. Also, this treatment includes descriptions of two new species (*Drepanopeziza verrucispora* Baral & Weber, *Symphyosirinia clematidis* Baral) and four new combinations. *L.M.K.*

Catalogue of The Colorado Flora: A Biodiversity Baseline, by W. A. Weber and R. C. Wittmann. Hardcover, 285 x 220 mm, 215 pp., 1992. The University Press of Colorado, P.O. Box 849, Niwot, CO 80544.

Listed here are 694 accepted taxa of lichens, 92 of hepatics, 375 of mosses, 3,088 of vascular plants and 1,100 bibliographic citations . Of the lichen taxa, 36 were described from Colorado, 18 of which are accepted here; none of the lichen taxa are considered endemic or adventive. Accepted names, synonymies, generic acronyms and coded bibliographic references are provided for entries. *L.M.K.*

Author Index to Volume Forty-six

Adler, Mónica and Susana Calvelo. New reports of Parmeliaceae *s. str.* (Lichenized Ascomycotina) from Southwestern Argentina. 105-127
Alcorn, J. L. and S. M. Francis. *Alternaria triglochinicola* sp. nov. 359-361
Alfenas, A. C. see Crous, Wingfield and Alfenas
Allen, John W. see Guzmán, Bandala and Allen
Arambarri, A. M. see Cazau, Arambarri and Cabello
Archer, Alan W. Identification of Orcinol Para-Depsides in the lichen genus *Pertusaria* by thin layer chromatography. 1-4
Bandala, Victor M. see Guzmán, Bandala and Allen
_____. see Guzmán, Bandala and King
Barr, D. J. S. see Ho, Barr, Abdullah, Jalaludin and Kudo
Barr, Margaret E. Redisposition of some taxa described by J. B. Ellis. 45-76
_____. Some pyrenomycetes on three ericaceous hosts in Western North America. 387-402
_____. see Samuels, Barr and Lowen
Barrasa, J. M., J. Checa and A. T. Martínez . *Crassoascus*, a new nonstromatic genus in the Clypeosphaeriaceae. 299-305
Bernicchia, Annarosa. *Hyphoderma etruriae* sp. nov. (Corticiaceae, Basidiomycetes) from the natural reserve of Burano, Italy. 37-40
Bhattacharya, R. see Roy and Bhattacharya
Bohn, Michael. *Myrothecium groenlandicum* sp. nov., a presumed endophytic fungus of *Betula nana* (Greenland). 335-341
Braun, U. and V. B. Hosagoudar. *Endoconospora indica* spec. nov. 259-261
_____. **and C. T. Rogerson.** Phytoparasitic hyphomycetes from Utah (USA). 263-274
Brodo, Irwin M. and Pak Yau Wong. Lichenes Canadenses Exsiccati: Fascicle IV. 135-140
Burguete, A. see Moreno, Illana and Burguete
Cabello, M. N. see Cazau, Arambarri and Cabello
Callan, Brenda E. and Jack D. Rogers. A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features. 141-154
Calvelo, Susana see Adler and Calvelo
Castilla, A., G. Moreno and C. Illana. A new species of *Comatricha* with incompletely reticulated spores from Spain. 315-319
Cazau, M. C., A. M. Arambarri and M. N. Cabello. New Hyphomycetes from Santiago River VI (Buenos Aires Provence, Argentina). 235-240
Checa, J. see Barrasa, Checa and Martínez
Courtecuisse, Regis see Kobayashi and Courtecuisse
Crous, P. W. and M. J. Wingfield. Additions to *Mycosphaerella* in the fynbos biome. 19-26
_____., **M. J. Wingfield and A. C. Alfenas.** Additions to *Calonectria*. 217-234
Dayal, R. Rajeshwari see Hosagoudar, Dayal and Goos
Demoulin, V. *Calvatia pachyderma* (Peck) Morg. and *Gastropila fragilis* (Lév.) Homrich et Wright, two possible names for the same fungus. 77-84
De Vroey, C. see Guarro, Gené and De Vroey
Dorai, M. see Vital and Dorai
Elshaffie, A. E. see Gené, ElShafie and Guarro
Etayo, J. *Lecanora navarrensis*, a new lichen species from North Spain. 453-458
Francis, S. M. see Alcorn and Francis

Gams, Walter see Pfenning and Gams
Gené, J., A. E. ElShafie and J. Guarro. Two new coprophilous Pezizales from the Sultanate of Oman. 275-284
_____. see Guarro, Gené and De Vroey
Ginns, J. *Phlebia pallida* in North America. 321-327
Goos, R. D. see Hosagoudar, Dayal and Goos
Guarro, J., J. Gené and C. De Vroey . A new species of *Spiromastix* from Africa. 307-313
_____. see Gené, ElShafie and Guarro
Guzmán, Gastón, Victor M. Bandala and John W. Allen. A new bluing *Psilocybe* from Thailand. 155-160
_____ **, Victor M. Bandala and Chris C. King.** Further observations on the genus *Psilocybe* from New Zealand. 161-170
Hanlin, Richard T. *Cookeina sulcipes* - an addendum. 403-405
Hestermark, Geir. *Umbilicaria dendrophora.* 211-215
Ho, Y. W., D. J. S. Barr, N. Abdullah, S. Jalaludin and H. Kudo. *Neocallimastix variabilis*, a new species of anaerobic fungus from the rumen of cattle. 241-258
Hosagoudar, V. B., R. Rajeshwari Dayal and R. D. Goos. Meliolaceae of Southern India - XII. 201-210
_____. see Braun and Hosagoudar
Illana, C. see Castilla, Moreno and Illana
_____. see Moreno, Illana and Burguete
Jalaludin, S. see Ho, Barr, Abdullah, Jalaludin and Kudo
King, Chris C. see Guzmán, Bandala and King
Kobayashi, Takahito and Regis Courtecuisse. Two new species of *Inocybe* from Japan. 27-33
Kohn, L. M. Book reviews. 485-489
Kudo, H. see Ho, Barr, Abdullah, Jalaludin and Kudo
Kuo, Ker-chung. A revision of *Bulbouncinula bulbosa*: A new powdery mildew record from Taiwan, and its presumed anamorph. 93-96
La, Yong-joon see Shin and La
Lai, Ming-Jou see Mattsson and Lai
Lowen, Rosalind see Samuels, Barr and Lowen
Martínez, A. T. see Barrasa, Checa and Martínez
Mattsson, Jan-Eric and Ming-Jou Lai. *Vulpicida*, a new genus in Parmeliaceae (Lichenized Ascomycetes). 425-428
McKenzie, E. H. C. New hyphomycete species from litter in the Chatham Islands, New Zealand. 291-297
Mills, Alan and Angela Monks. Unusual spore print colouration within the family Hygrophoraceae: Two distinctive taxa recorded from Tasmania. 85-91
Monks, Angela see Mills and Monks
Moreno, G., C. Illana and A. Burguete. Spanish Myxomycetes. VII. (Province of Castellon). 407-424
_____. see Castilla, Moreno and Illana
Mouton, Marnel, Michael J. Wingfield, P. Schalk Van Wyk Conidium development in the *Knoxdaviesia* of *Ceratocystiopsis proteae*. 363-370
_____ **, Michael J. Wingfield, P. Schalk Van Wyk.** Conidium development in the synnematous anamorphs of *Ophiostoma*.. 371-379

Norvell, Lorelei see Redhead and Norvell
Oberwinkler, Franz see Pfenning and Oberwinkler
Ogawa, Yoshio see Tubaki, Tan and Ogawa
Pagano, Sabine see Zucconi and Pagano
Pfenning, Ludwig and Walter Gams. *Mortierella paraensis* n. sp. from Brazilian soil. 287-290
_____. **and Franz Oberwinkler***Ophiostoma bragantinum* n. sp., a possible teleomorph of *Sporothrix inflata* found in Brazil. 381-385
Rai, M. K. Identity and taxonomy of hitherto unreported pathogen causing leaf spot disease of ginger in India. 329-333
Redhead, Scott A. and Lorelei L. Norvell. *Mycena gaultheri* rediscovered after 50 years. 97-104
_____. **and** _____. *Phaeocollybia* inWestern Canada. 343-358
Rogers, Jack D. see Callan and Rogers
Rogerson, C. T. see Braun and Rogerson
Roy, Anjali and R. Bhattacharya. Occurrence of *Gloeophyllum sepiarium* (Wulf.:Fr.) Karst. in India. 5-9
Samuels, Gary J., Margaret E. Barr and Rosalind Lowen. Revision of *Schizoparme* (Diaporthales, Melanconidaceae). 459-483
Shin, Hyeon and Yong-joon La. Morphology of edge lines of chained immature conidia on conidiophores in powdery mildew fungi and their taxonomic significance. 445-451
Simmons, Emory G. *Alternaria* themes and variations (54-62). 171-199
Takada, Masaki and Shun-ichi Udagawa. *Talaromyces indigoticus*, a new species from soil. 129-134
Tan, Teck Koon see Tubaki, Tan and Ogawa
Tubaki, Keisuke, Teck Koon Tan and Yoshio Ogawa. Water-borne hyphomycetes in Singapore, with a description of an undescribed species of *Trichocladium*. 437-444
Udagawa, Shun-ichi see Takada and Udagawa
Vanev, Simeon G. *Ramularia biscutellae* sp. nov. 35-36
_____. *Discosia arxii* sp. nov. 41-43
Van Wyk, Schalk see Mouton, Wingfiled and Van Wyk
Vittal, B. P. R. and M. Dorai. *Minimidochium indicum*, a nomenclatural correction. 285
Wingfield, B. D. and M. J. Wingfield. The value of dried fungal cultures for taxonomic comparisons using PCR and PFLP analysis. 429-436
Wingfield, M. J. see Crous and Wingfield
_____. see Crous, Wingfield and Alfenas
_____. see Mouton, Wingfield and Van Wyk
_____. see Wingfield and Wingfield
Wong, Pak Yau see Brodo and Wong
Zucconi, Laura and Sabina Pagano. Concerning the generic limits in *Haplographium*. 11-18

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME FORTY-SIX

This index includes the names of genera, infrageneric taxa, species, and infraspecific taxa. New names are in **boldface**, as are the page numbers on which new taxa are proposed.

Acanthonitschkea
foveolata 49
horrida 49-50
Acanthostigma
atrobarbum
var. piniolum 63
berenice 68
decastylum 46, 48
filisporum 45, 58, **63**
perpusillum 63
saccardioides 68
spinosum 46
Acerbia 48
bacillata 48
Aeruginospora 85, 90
singularis 85, 90
Agaricus
christinae 356
Agrestia 136
hispida 135-136
Alternaria 171-173, 176, 178, 180-182, 187, 192, 194, 196-199, 300, 304, 359, 361
aliena 171, 178-179, **180**, 196
alternata 172, 181, 189-190, 197
anagallidis 176
aragakii 171, **181**-184, 186, 196
cheiranthi 194
chrysanthemi 361
dennisii 361
dianthicola 180
dichondrae 176, 198
euphorbiicola 180
hawaiiensis 171, **184**-186, 196
infectoria 197
latifunda 171, **194**-196
leucanthemi 361
molesta 194
mouchaccae 194
multirostrata 176, 198
obclavoidea 171, **192**-194, 196
passiflorae 171-178, 180-181, 184, 186-187, 192, 196-199
sonchi 180
tenuis 172, 181, 189
tenuissima 171, 189-191, 196
tomato 172, 180-182, 184, 198-199
triglochinicola 359-361
triticina 194
tropica 171, **187**-189, 196
Amazonia 201, 210
syzygii 201-202
Amphisphaerella 300, 390, 392
Amphisphaeria 55, 76
andropogonis 54
atroograna 72
confertissima 68, 72
cupula 55
deformata 68, 72
eckfeldtii 67
multipunctata 54
pardalina 54
pilosella 68, 72
Angulospora
aquatica 438, 440, 443
Anisomeridium
biforme 458
Anthasthoopa 483
Anthopsis
microspora 442
Anthostoma
sustentum 392
Anthostomella 392, 402
exutans 392
tomicoides 392
unguiculata 391-392
Anthracothecium 401
Antrodia
macrospora 37
Anzia 126
Arcyria 408
abietina 408
carnea 408
cinerea 408
denudata 408
gulielmae 408
leiocarpa 408-410, 422
minuta 408
obvelata 411
pomiformis 411
stipata 408
Arthonia 65

[Arthonia] byssacea 136
xylogena 65, 68
Arthrocladiella 445-446, 448-449
mougeotii 447, 449
Ascowtaiwania 300, 304-305
lignicola 304
Aspicilia 136, 140
Asterella
subcyanea 73
Asteridiella 201
sapotacearum 201-203
Asterina
subcyanea 73

Bacidia
fuscorubella 136
polychroa 136
Badhamia
dictyospora 414
foliicola 411
gracilis 411
macrocarpa 411
obovata 413
panicea 411
rubiginosa 413
var. dictyospora 414
Belemnospora 297
Beltrania
rhombica 438, 440, 443
Biscogniauxia 152, 394
exutans 387, **392**, 394
nummularia 394
Blastobotrys 378, 384
Blumeria 445-446, 448-449
graminis 447, 449-450
Botryosphaeria 395
Bulbouncinula 93, 96
bulbosa 93-96
Byssosphaeria
barbicincta 47
luteobasis 53

Caecomyces
equi 257
Cainia 55, 75
cupula 55
Calcarisporiella 378, 384
Calcarisporium 378, 384
Calonectria 217-218, 224, 232-234
avesiculata 234
colhounii 218, 220, 232-233
var. colhounii 218, 220, 222-223
var. macroconidialis 220, **222**
daldiniana 233
floridana 234
gracilis 224
ilicicola 233
kyotensis 234
pteridis 227-**228**, 230
pyrochroa 217, 233
theae 233
uniseptata 234
Calostilbe 76
Calvatia 80-84
booniana 77-79, 81
craniiformis 82
fragilis 80
pachyderma 77-84
Camarophyllus
rodwayi 86
Camarops 54
microspora 53
Campylospora
parvula 438, 440, 443
Capnodium
walteri 394
Capronia
minima 394
nigerrima 394
Catenularia 75
Catillaria 455
Catinaria 455
pulverea 455-456, 458
Ceramothyrium 68, 75
carniolicum 68
linnaeae 68
martinii 67-68, 70
Ceratiomyxa
fruticulosa 411
Ceratocystis 363-364, 366, 369-371, 378, 381, 384-385
adiposa 429, 431-432, 434
fimbriata 434
moniliformis 434
piceae 378
ulmi 370, 378
Ceratocystopsis 363-364, 366, 370, 378, 385
proteae 363-364, 366, 369-370
Ceratostoma
albocoronatum 60
cirrhosa 60
conicum 60
Ceratostomella 53, 60, 74
conica 58, **60**
longispora 48

Cercophora 46, 75
solaris 46
spinosa 45, 50
Cercospora 274
coalescens 264
geranii 267
ithacensis 273
omphacodes 267
phlogina 267
Cercosporella
geranii 273
Cercosporidium 264
Cetraria 127, 425-426, 428
subg. Platysma 427
sect. Flavidae 427
subsect. Cucullatae 427
[indef. rank] Sulphureae 427
alvarensis 428
canadensis
var. viridis 427
chlorophylla 106-108
ciliaris 425
islandica 425
juniperina
var. canadensis 427
var. tubulosa 427
tilesii 428
tubulosa 428
viridis 428
Cetrariastrum 109, 125
americanum 105, 108-109
cirrhatum 109
vexans 109
Chaetomastia 401
hirtula 397
littoralis 387, **397**-398
sambuci 397
scelesta 68, **71**
Chaetoplea 400
crossata 400
pusilla 400
Chaetosphaeria 48, 75
atriella 46-47, 50
barbicincta 47
callimorpha 47
pulviscula 47
Chaetothyrina 73
applanata 68, **73**
asterinoides 73-74
Chaetothyrium
berenice 68
Chalara 293, 297, 363
alabamensis 292
australis 291-293
distans 291-**292**, 293
hughesii 292
Charonectria 482
Chondrostereum 324
Cilioplea
amplispora 400
Circinotrichum 294
britanicum 294
chathamiensis 291, **293**-295
cochinense 294
flagelliforme 294
ponmundiense 294
Cladia 140
Cladina 140
Cladonia 140
bacillaris 136, 140
cariosa 136
dahliana 136
macilenta 135-136, 140
phyllophora 136
pleurota 136
squamosa 136
symphycarpa 135-136
turgida 136
verruculosa 135-136
Cladosporium 12
Clypeosphaeria 304, 401
americana 304
mamillana 304, 390
ulmicola 57
Codinaea 47
Coelosphaeria
fusariospora 62, 64
Coleroa
pusiola 72
Collaria
lurida 411
Colletotrichum 25
gloeosporioides 21
Comatricha 315, 318-319
anomala 318, 407
cylindrica 318
lurida 411-412
meandrispora 315-318
nigra 412
orthotricha 318
pulchella 407, 412
reticulata 318
reticulospora 318
rispaudii 318
subalpina 318
tenerrima 412-413
Concamerella 125
Condylospora 444

[Condylospora] spumigena 438, 440, 443
Coniella 459-460, 464, 474-476, 478, 481, 483
castaneicola 459-460, 463, 472
fragariae 478
granati 459-460, 463, 480
Coniochaeta 49
subg. Helminthosphaeria 50
arctespora 49-50
ligniaria 50
pulveracea 49
saccardoi 50
velutina 49
xylariaespora 49
Cookeina 403-404
sulcipes 403-404
tricholoma 403
Copelandia 156
Coprotus 275, 284
dhofarensis 275-**276**, 278-279
marginatus 280
trichosurus 284
Cornicularia 428
Crassoascus 299-**300**, 303-304
fusisporus 299-301, **302**-303
Craterium
globosum 413
leucocephalum 413
minutum 413
muscorum 413
obovatum 407, 413-414
var. dictyosporum 407, 413-**414**
var. globosum 413
var. obovatum 413-414
Cresporhaphis
rhoina 58, **64**
wienkampii 64
Cribraria
cancellata
var. fusca 414
confusa 415, 423
microcarpa 414
minutissima 407, 414-415, 423
violacea 416
Cryptococcus 435
Cryptonectriella 482
Cryptophiale 296-297
insularis 291, **294**-296
minor 296
secunda 296
Cryptophialoidea 296-297
Cryptosporiopsis 368, 370
Culicidospora 438, 440, 443
aquatica 438, 440
Cyclodomella 483
Cylindrocarpon 223, 233
Cylindrocladiella 233
Cylindrocladium 217-218, 223, 227, 233-234
clavatum 224
colhounii 218, 220
var. colgounii 218, 220, 222
var. macroconidialis 220, **222**
gracile 218, 223-224, 232
macrosporum 227, 232-234
pteridis 218, 227-228, 230, 233-234
scoparium 217, 233-234
Cylindrosporium
geranii 267
Cystotheca 445-446, 448
lanestris 447, 450

Daruvedia
bacillata 48
Decaisnella
pachyspora 398, 401
Diachnea
leucopodia 416
Diapleella 400
Diaporthe 388-389, 402
eres 388
linearis 389
pardalota 388
vaccinii 389
Diatrype
exutans 392
microspora 53
var. exutans 53
prominens 390
Dictydiaethalium
plumbeum 416
Dictyothyrium
subcyaneum 73
Diderma 416, 423
cingulatum 407, 416-417
globosum 416, 423
rimosa 416
spumarioides 416-417, 423
umbilicatum 417
var. macrospora 407, 417, 422
var. umbilicatum 417
Didymaria
wyethiae 273
Didymella 71
anomala 71
corylina 54
Didymium

[Didymium] bahiense 417
difforme 418
eximium 418
marineri 418
melanospermum 418
minus 418
squamulosum 418
vaccinum 418
Didymolepta 71
anomala 70
Didymosphaeria 74
anomala 70
catalina 62
cupula 55
futilis 401
major 54
oblitescens 401
sphaerophora 58
Dimerosporium
populi 65
xylogenum 65
Diplocladiella 442
appendiculata 237, 240
heterospora 237
scalaroides 237
taurina 235, **237**-238
tricladioides 237-238, 442
Discochora 70
Discosia 41, 43
sect. Strobilina 41, 43
artocreas 42
arxii 41-43
elliptica 43
ocellata 43
pleurochaeta 43
smilacina 43
strobilina 43
Discostroma 55
corticola 54, 56
cupulum 55, 58
fuscella 54
massarina 55-56
muricatum 56
rubicola 56, 58
tostum 55
Ditopellopsis
clethrae 389
linearis 387, **389**, 392
racemula 389
Dothidea
rugodisca 388
Dwayaangam 236
cornuta 236
dichotoma 236
gamundiae 235-236, 238
quadridens 236
yakuensis 236

Elsinoe
ledi 394
mattirolianum 394
Embellisia 361
Endoconospora 261
cerastii 261
indica 259-261
Endotryblidium
insculptum 394
Endoxyla 53, 60
luteobasis 53, 58
operculata 53
Endoxylina
allantospora 54, 76
astroidea 54
Enteridium
lycoperdon 419
Erysiphe 445-446, 448-449
arabidis 447
artemisiae 447, 449
cichoracearum 445, 447, 449, 451
galeopsidis 447, 450
rubiae 447
sordida 447
Eupenicillium 134
Europhium 369
Eutypa
luteobasis 53
Evernia
americana 108
Everniastrum 109, 126-127
Exarmidium 62, 75
diaphanum 62
fusariispora 63
morthieri 62

Fenestella
amorpha 58
ulmicola 58
Flavoparmelia 111, 126
baltimorensis 112
ferax 105, 110-111
haysomii 111-112
Fomes
durissimus 9
Fuligo
septica 419
Fusarium 368-369

[Fusarium] sect. Liseola 370
crookwellense 370
culmorum 370
oxysporum 435
sacchari
f. sp. subglutinans 370

Gaertneriomyces 257
Gastropila 78, 80-83
fragilis 77-80, 84
Geniculosporium 141-142
Gibbera
atrograna 72
confertissima 72
pilosella 72
Gloeophyllum
sepiarium 5-6, 8
Gloeosporium
castaneicola 472
Gloniopsis
praelonga 395
Glyphium
elatum 401
Gonohymenia 137, 139
nigritella 137
Gnomonia 74, 401
Gnomoniella 459, 463, 482
destruens 459, 462-463, 471
Graphilbum 378
Graphiocladiella 378
Graphium 363, 371, 377-379
penicillioides 371, 378
piceae 372, 374, 377
ulmi 372, 374, 377
Guignardia 70, 75
apocyni 68, **70**
bidwellii 70, 75
vaccinii 395
Gymnoascus 312
Gyrophora
cylindrica 213

Hadrotrichum 142
Haematomma
leprarioides 458
Handkea 82
Haplographium 11-13
bicolor 12-13
calophylli 12, 18
catenatum 11-13
debellamarengoi 12
delicatum 11-12
heliocephalum 11-12, 14-17
mangiferae 12
Helicosporium 438, 442-443
Hemitrichia
abietina 408
clavata 419
leiocarpa 408
Heptameria
sabalicola 57
Herpotrichia 76
barbicincta 47
macrotricha 400
nicaraguensis 45, 61
Heterodermia
obscurata 458
Homostegia 388
kelseyi 55
Humicola 385
dimorphospora 381-382, 384
Hyalopesotum 378
Hyalorhinocladiella
Hyaloscypha
dematiicola 11-12
Hydronectria 482
Hydrothyria
venosa 137
Hygrocybe 85, 88, 90
erythrocrenata 85, **87**-90
lilaceolamellata 85-86, 88-90
Hygrophorus 88, 90-91
Hymenopleella 305
Hyphoderma 37, 40
etruriae 37-**38**, 39
orphanellum 37, 39
Hypocreopsis 341
Hypogymnia 426
Hyponectria
fusispora 387, **390**, 392
Hypotrachyna 126
brevirhiza 112-113
densirhizinata 105, 113-114
sinuosa 105, 114
swinscowii 121
Hypoxylon 52, 144, 153, 394, 402
sect. Primocinerea 76
nummularium 394
serpens 142, 153
vogesiacum 394
Hysterium
pulicare 395
Hysterographium
flexuosum 395
mori 395

Immotthia
atrograna 68, **71**-73
Ingoldiella
hamata 438, 442-444
Inocybe 27, 30, 33, 357
subg. Inocybe 30, 33
subg. Inosperma 33
super-sect. Cortinatae 30
super-sect. Marginatae 33
chrysochroa 27, **30**-31, 33
mixtilis 33
paludinella 30
pseudorhacodes 27-**28**, 29-30
rhacodes 30
Iodosphaeria
arundinariae 47, 50
Irene
sapotacearum 202

Jobellisia 45, **60**
luteola 58, **61**-62
nicaraguensis 58, **61**
Johansonia
cupulata 65
formosa 65, 68
Julella
fallaciosa 137

Kalmusia
clivensis 400
coniothyrium 400
Knoxdaviesia 363-364
proteae 363-366, 369
Kochiomyces 257

Laestadia 70
alnea 70
apocyni 70
castanicola 55
Lamproderma
scintillans 419
Langermannia 81-83
pachyderma 80
Lasallia 215
Lasiosphaeria 47-48
ellisii 45, **48**, 50
luteobasis 53
munkii 46, 390
raciborskii 48
Lecanora 453, 455-456
allophana 135, 138
expallens 455
navarrensis 453-**454**, 455-456
rugosella 138
strobilinoides 458
symmicta 455
Lecidea
cinnabarina 456, 458
Leiosphaerella
fusariospora 62
hamasporum 63
praeclara 391-392
rhoina 62
Leocarpus
fragilis 419
Lepteutypa 300, 305
alpestre 56, 58
cupressi 57
sabalicola 57-58
ulmicola 57-58
Leptographium 363-364, 369, 372, 379
procerum 374
terebrantis 374
truncatum 374
Leptorhaphis 74
Leptosphaeria 75, 400
anomala 70-71
gaultheriae 400
sabalicola 57
Leptosporella
fusariospora 62, 64
rhoina 64
Letendraea 61, 76
luteola 45, 60-61
Letharia 425
columbiana 138
Lichen
chlorophyllus 106
juniperinus 427
var. alvarensis 428
pinastri 428
sinuosus 114
Linocarpon 75
hamasporum 58
Lophiostoma
fuckelii 400
microstoma 71
scelestrum 71
scrophulariae 400
Lycoperdon 78-79, 82-83
pachydermum 77-80

Macbridella 76
Macrosporium 173, 198
  tomato 182
Macrovalsaria 76
Massarina
  corticola 400
  eccentrica 400
  lignorum 400
  microcarpum 400
Massariovalsa
  californica 389
Megalospora
  tuberculosa 458
Melanconiopsis 476, 478
Melanconis 402, 478
Melanconium 476, 478, 483
  apiocarpum 370
  bicolor 370
Melanelia 425
  subglabra 115
Melanomma
  alpestre 56
  eckfeldtii 66
  rhododendri 400
Melanophyllum 90
  echinatum 90
  eyrei 90
Melanopsamma
  eckfeldtii 67
  innumerosa 67
  pomiformis 75
Meliola 201
  aethiops 206
  barringtoniae 205
  bicornis 201, 204
  caesalpiniicola 206
  canarii 201, 203-204
  densa 202
  holigarnae 201, 204
  indica 201, 204-205
    var. careyae 205
  kingiodendri 201, **205**, 207
  machili 201, 206
  malabarensis 201, 206
  mangiferae 201, 206
  mayapeae 201, 206-207
  neissleana 388
  nidulans 388
  nigro-rufescens 204
  pterocarpi 201, 208-209
  tamarindi 201, 208
  zigzag 202
Melomastia
  mastoidea 390, 392
Memnoniella 15, 18
Menegazzia 426
  terebrata 458
Menispora 47
Meruliopsis 324
  corium 324-325
Metasphaeria
  rubicola 56
Metatrichia
  vesparium 419
Micarea 453
Micropeltis 74
  subcyanea 68, **73**
Microsphaera
  penicillata
    var. vaccinii 388
  vaccinii 388
Microthelia
  anomala 70
  cupula 55
Minimidochium 285
  eucalypti 285
  indicum 285
Molliardiomyces 404
Monascostroma
  eckfeldtii 66, 68
Monographella 76, 305
  fusariispora 58, **63**
Mortierella 287, 290
  sect. Hygrophila 287-288
    beljakovae 288, 290
    hyalina 288
    kuhlmanii 288, 290
    paraensis 287-290
Mycena 98, 103-104
  sect. Basidipes 97-98, 102-104
  sect. Bulbosae 104
  sect. Clavulares 194
  sect. Exiguae 104
  sect. Gaultheria 97
  sect. Longisetae 104
  sect. Polyadelphia 97-98, 102, 104
  sect. Pseudotsuga 97
  sect. Sacchariferae 104
  sect. Saetulipedes 104
  sect. Testudini 97, 103-**104**
    gaultheri 97-98, 102-104
    mucor 102
Mycenastrum
  fragile 77, 79-80
Mycoacia 324
Mycoblastus
  sterilis 456
Mycomicrothelia 401

Mycosphaerella 19-22, 26
arbuticola 394
bellula 20, 22, 25
cussoniae 22, 24-25
gaultheriae 394
jonkershoekensis 19-20, 22, 26
proteae 19-20, 22
Myrothecium 335, 338, 340-341
atrum 338
cinctum 338
flavoviride 338
groenlandicum 335-**336**, 337-339
roridum 338

Nanoscypha 404
tetraspora 403, 405
Naucoria 357
jennyi 356
kauffmanii 349
Navicella
microstoma 71
Nectria 233, 340-341
subg. Hyphonectria 340-341
bactridioides 340
cinnabarina 390
epichloe 340
pityrodes 340
ralfsii 338, 340
Nectriella 459-460, 463, 482
versoniana 459-460, 462-463, 480-482
Nectriopsis 340-341
Neocallimastix 241-242, 246, 252, 257
frontalis 241, 257
hurleyensis 241, 258
joyonii 241, 257
patriciarum 241, 258
variabilis 241-**242**, 244, 246-250, 252-257
Neopeckia
diffusa 61
Neoramularia
asteris 273
Nephroma
arcticum 138
Nephromopsis 426-427, 428
Neurospora
crassa 435
intermedia 435
sitophila 435
Niesslia 47
barbicincta 47
erysipheoides 50
exilis 52
exosporioides 52
lanea 50, **52**
pulchriseta 52
Nodulisporium 141
Nummularia
exutans 394
Nummulariola
exutans 394

Oncopodiella 442
Ophioceras
subg. Acerbia 48
hyptidis 48
longispora 48
Ophionectria 76
Ophiostoma 363-364, 366, 369, 371, 377-379, 381, 384-385
albidum 384
bragantinum 381-384
cucullatum 370
davidsonii 372, 377
francke-grosmanniae 364
grande 384
olivaceapinii 372, 374
olivaceum 372, 377
piceae 371
roraimense 384
stenoceras 384
tetropii 384
ulmi 371
Orpinomyces 242
bovis 242, 257
joyonii 258
Ovularia
asteris 273
delphinii 274
lupinicola 274

Panaeolus 156
Pannaria 139
laceratula 135, 138
lepidota
f. corallifera 138
leucostictoides 138
Pannoparmelia 126
angustata 105, 115-116, 125
anzioides 106, 115-117, 124-125
Paradiachea 318
Parmelia 120-121, 126-127, 425, 428
subg. Amphigymnia 127

[Parmelia] subg. Hypotrachyna 127
subg. Parmelia 126
angustata 115
brevirhiza 112
brownii 116
citrinescens 110
cunninghamii 116
densirhizinata 113
ferax 110
haysomii 111
obversa 110
protosulcata 118
reticulata 122
saxatilis 117, 119-120
subaurifera
var. subglabra 115
sulcata 117, 120-121
swinscowii 121
Parmelina 126
swinscowii 121
Parmelinopsis
swinscowii 105, 121-122, 125
Parmotrema 124
cetratum 124
reticulatum 122-123
Passalora 264
mertensiae 263, 265
Patellaria
cyanea 45, 66
Patellea
cyanea 66
Peltigera 140
canina 139
elizabethae 138
pacifica 135, 138-139
polydactyla 138
retifoveata 135, 139
venosa 135, 139-140
Penicillium 134
indigoticum 129
Perichaena
depressa 419
Peristomialis 341
Pertusaria 1-3
acuta 1
cerussata 1
globularis 1
hartmannii 1
leucoplaca 1
mattogrossensis 1
paratuberculifera 1
pupillaris 456
subobductans 1
Pestalosphaeria 76, 300, 304-305
Pesotum 371-372, 379
piceae 372
Phaeocollybia 343-344, 346, 355-358
carmanahensis 343-345, **346**-349, 356
christinae 356
jennyi 356
kauffmanii 343-344, 349-357
oregonensis 349
spadicea 356
Phaeoisariopsis 274
Phaeonectria 76
Phaeoramularia 264, 266
coalescens 263-**264**
collomiae 263-**264**, 270
geranii 273
punctiformis 273
Phaeosaccardinula 68
martini 67
Phaeoxyphiella 394
Phialemonum
curvatum 313
Phialocephala 364, 370
Phialographium 364, 371-372, 377, 379
Phillipsia 404
crispata 403-404
domingensis 403-404
lutea 404
rugospora 403
Phillipsiella
atra 66
ellisii 45, **66**, 68
Phlebia 321, 324, 326
pallida 321-**322**, 323-324
radiata 324
Pholiota 357
Phoma 332
exigua 331
var. exigua 329, 332
fumosa 370
granati 460, 480
herbarum 331
sorghina 331
Phyllosticta
cussoniae 21
Physalospora 459-460
alpestris 459
Physarum
auriscalpium 420
bitectum 419
bivalve 420
cinereum 420

[Physarum] compressum 420
decipiens 420
didermoides
var. lividum 421
leucophaeum 420
leucopus 420
lividum 421
melleum 421
nutans 421
straminipes 421
vernum 421
viride 421
var. incanum 407, 421-422
Pilidiella
quercicola 482
Pirex 324
Piromyces
communis 242, 252, 257
Pithya 404
Plagiostoma 70
Platystomum
compressum 401
obtectum 71, 401
Plectania
coccinea 404
Pleomassaria 395
hesperia 396
holoschista 396
Pleospora
herbarum 198
triglochinicola 361
Pleurotheciopsis
websterii 235, **238**
Pleurotus 85
ostreatus 90
Plochmopeltis 74
ellisii 66
Podosphaera 445-446, 448
clandestina 447
leucotricha 447
tridactyla 447, 450
Polyblastiopsis
fallaciosa 137
Porpidia 140
carlottiana 135, 139
glaucophaea 139
Pronectria 482
Prosthecium 402
Protoventuria
gaultheriae 395
Pseudoarachniotus 313
Pseudocercospora 267, 273
geraniacearum 263, 265-**266**, 267
geranii 273
geraniicola 267
omphacodes 263, **267**
Pseudomassaria 401
corni 392
hesperia 387, **391**-392
Pseudonectria 460, 482
Pseudoparmelia 126
ferax 110
Pseudovalsa 402
Pseudovalsaria 54, 300
allantospora 53-54
phoedans 54
Psilocybe 155-156, 158-164, 166-170
sect. Coprophilae 167
sect. Cyanescens 167
sect. Mexicanae 155, 158
sect. Pratensae 167
sect. Semilanceatae 167
sect. Zapotecorum 160, 167, 169
acutipilea 158
armandii 158
aucklandii 159-160, 162-163, 167-168
australiana 159-160, 165-168
brunneocistidiata 159
caerulipes 161, 164, 167
callosa 164
coprophila 161-164, 167-168
cordispora 155, 158
cubensis 156
cyanescens 166
eucalypta 159, 161, 165-168
farinacea 158
galindii 158
goniospora 158
inconspicua 159
kumaenorum 159
lonchoporus 158
mexicana 158
novae-zelandiae 161-162, 167-168
ochreata 159
papuana 159
samuiensis 155-**156**, 157
semilanceata 155, 158-159, 161-164, 167-168
subaeruginascens
var. subaeruginascens 159
subaeruginosa 159-160, 166, 169
subcubensis 156
tampanensis 158
tasmaniana 159, 166
Psilosphaeria
atriella 46

Punctelia 127
Pyrenula 401

Radulum 321, 326
pallidum 321-322, 325
Ramelia 123, 126
reticulata 122
Ramularia 35-36, 269, 271-272, 274
achilleae 269
achilleae-millefolii 263, **267**-268
actaeae 271
actaeina 273
arvensis 269, 273
var. arvensis 269
var. cercosporelloides 263, **269**-270
asteris 273
biflora 273
biscutellae 35-36
carneola 273
coalescens 264
delphinii 274
delphiniicola 274
epipactidis 263, 268, **271**
filaris 274
giliae 274
glauca 274
grevilleana 274
ionophila 273
lophanthi 274
lupinicola 274
maculicola 263, 268, **271**
montana 273
rudbeckiae 274
sambucina 274
senecionis 274
sidalceae 274
smilacinae 274
taraxaci 271
tulasnei 274
urticae 274
valerianae 274
variabilis 274
Rhizocarpon
grande 139
Rhopographus
fusariispora 63
Rhynchosphaeria
irpex 300
Rinodina
isidioides 458
Rosellinia 50, 76, 152
arctespora 49
bigeloviae 49
parasitica 49
spinosa 45
subcompressa 49
xylariaespora 49

Saccardia
martini 67
Saccardoella 299
Sarcodontia 326
Sarcoscypha 404
austriaca 403
coccinea 403-405
var. jurana 403
dudleyi 404
occidentalis 403
Sawadaia 445-446, 448
negundinis 447
polyfida 447
Schismatomma
quercicola 456
Schizoparme 459-461, 463-**464**, 465, 474, 481
angustispora 459, 462-463, **465**-466
botrytidis 459, 462-463, 465, **468**
destruens 462-463, 465, **470**-472
straminea 459-465, 472-474, 482
stromatica 459, 462-463, **474**, 476, 478
terminaliae 459, 462-463, 465, 471-472, **478**-479
versoniana 459, 462-463, 465, 474, **480**
Schizothyrium
pomi 394
Scutisporus 438, 442-443
brunneus 438, 442-443
Sinodidymella 398
occidentalis 387, **397**-398
verrucosa 398, 402
Siphula
ceratites 139
Sistotrema
hamatum 442, 444
Sphaerella 26
Sphaeria
subg. Coelosphaeria 62, 64
subg. Didymosphaeria 55
subg. Winteria 64
albocincta 62
arctespora 49-50
atriella 46, 48

[Sphaeria] atrograna 71-72
avocetta 53
barbirostris 63
berenice 68
cupula 55
diaphana 62
eckfeldtii 66
fusariospora 62, 64
lejostega 54
longispora 45, 48
luteobasis 53
ovalis 49
pachyascus 71
pholidigena 49
quercifolia 55
rhoina 64
sabalicola 57
soluta 62
succinea 55
xylariaespora 49-50
Sphaerotheca 445-446, 448-449
aphanis 447, 450
balsaminae 447, 449
ferruginea 448
fuliginea 445, 448-449, 451
fusca 448-449
pannosa 448
phaseoli 448-449
Spiromastix 307, 311-312
grisea 307, 311-313
tentaculatum 307-**308**, 310-312
warcupii 307, 311-313
Spizellomyces 257
Splanchnonema 395
arbuti 387, **395**-396, 398
vaccinii 387, **396**, 398
Sporendocladia 363
Sporothrix 363, 374, 377-378, 384
inflata 381-382, 384
schenckii 384
Stachybotrys 15, 18, 75, 364
Stanhughesia 68, 75
Stemonitis
fusca 422
Stemonitopsis
amoena 422
Stemphylium
triglochinicola 361
Stenella 272
Stigmina 273
collinsiae 263, 268, **272**
Stigmochora 482
Stilbum
catenatum 11
Talaromyces 129, 134
sect. Talaromyces 132
ser. Flavi 132
flavus 134
indigoticus 129-134
Teichospora
juglandia 400
hesperia 387-**398**, 400
Teratosphaeria
protea-arboreae 26
Thecotheus 275, 284
cinereus 282
harasisus 275, **280**, 282
himalayensis 284
Thelopsis
rubella 458
Thyrea
confusa 137
nigritella 137
pulvinata 137
Thyridaria
macrostomoides 401
turrita 401
Thyridium
vestitum 58
Titaeela
capnophila 442
Titania 402
Tolypocladium
niveum 313
Trentepohlia 456
Trichia
botrytis 422
contorta 422
varia 422
Trichocladium 437-438, 440
cylindroclavatum 440
singaporense 437-**438**, 439, 441
Trichoderma 368
saturnisporum 369
Trichonectria 341
Trichosphaerella
decipiens 390
Trichosphaeria
arundinariae 47
cellaris 52
flavida 52
horrida 49
Tricladium 438, 442-443
Triparticalar 257
Tripospermum 440, 442-444
camelopardus 438, 442

Triposporina
quadridens 236
Triscelophorus 442-443
acuminatus 438, 442
Tubercularia 461
Tuckermannopsis 425-426

Umbilicaria 213-215
cylindrica 213-214
var. delisei 213-214
dendrophora 211-214
propagulifera 213, 215
umbilicarioides 213
vellea 212-213
var. dendrophora 211
Uncinula 93, 95
bulbosa 93
clintonii
var. bulbosa 93
Usnea 425

Valsa 390
ceratosperma 389
delicatula 390
Valsaria
allantospora 54
coloradensis 54
Valsonectria
cinnamomi 58, 75
hypoxyloides 58
Vararia
maremmana 37
Venturia 73
applanata 70, 73
asterinoides 73
barbula
var. foliicola 52
cupulata 65
erysipheoides 50
formosa 65
graminicola 50
hispida 52
lanea 52
parasitica 52
psilotricha 65
sabalicola 52
saccardioides 68, 70
vaccinii 52
Verticicladiella 370, 372, 379
wageneri 435
Vulpicida 425-**427**
canadensis 425, **427**
juniperinus 425, **427**
pinastri 425, **428**
tilesii 425, **428**
tubulosus 425, **428**
viridis 425, **428**

Wettsteinina 76
anomala 71
Winterella
rhoina 64
Winteria
rhoina 64
Wuestniopsis 389

Xanthoparmelia 425
Xanthothecium
peruvianum 313
Xeromphalina 357
Xylaria 141-144, 146, 150, 152-154
acuta 146, 153
allantoidea 146, 150, 153
apiculata 144, 146
arbuscula 146
bulbosa 153
carpophila 144, 146, 152
coccophora 144, 146, 150
corniformis 144, 146, 152-153
cornu-damae 144, 146, 150, 153
cubensis 142, 144, 146, 150, 153
curta 146, 153
hypoxylon 146
longiana 146, 150, 152
longipes 142, 146, 152-153
magnoliae 146, 150, 152-153
mali 152-153
microceras 146
multiplex 146
oxyacanthae 144, 146, 152, 154
persicaria 146, 152
poitei 144, 146, 150, 153-154
polymorpha 146, 150, 154
psamathos 146
schweinitzii 146, 150
tentaculata 144, 146, 150
Xylocoremium 141-142
flabelliforme 153

Zamenhofia
coralloidea 458
Zigonella
atriella 46
eckfeldtii 67

Reviewers, Volume Forty-Six

The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume:

T. Ahti
J. Ammirati
G. G. Bakalova
R. J. Bandoni
M. E. Barr
U. Braun
I. M. Brodo
F. P. Calonge
G. Chamuris
O. Constaninescu
B. J. Coppins
M. Corlett
Y. Dalpe
E. Descals
N. E. El-Gholl
J. A. Elix
W. Gams
I. Gamundi de Amos
J. Ginns
H. B. Gjærum
J. H. Haines
N. Hallenburg
V. Holubová-Jechová
E. Horak
S. Huhndorf
J. A. G. Irwin
W. B. Kendrick
P. M. Kirk
R. P. Korf
J. C. Krug
D. Malloch
W. F. O. Marasas
G. Morgan-Jones
N. E. Nannenga-Bremekamp
A. Nawawi
M. E. Palm
S. Redhead
S. C. Redlin
J. D. Rogers
K. A. Seifert
R. Shoemaker
E. L. Stewart
R. P. Thakre
L. Tibell
F. A. Uecker
R. Watling
J. E. Wright
K. Yokoyama
R.-y. Zheng

ERRATA, VOLUME FORTY-ONE

Page	300	line 49	*insert after "et"*		isotypus in

ERRATA, VOLUME FORTY-THREE

Page	389	line 37	*insert after "et"*		isotypus in

ERRATA, VOLUME FORTY-FIVE

Page	61	*for*	Oidiopsis glaucae	read	*Oidiopsis thyrallidis*
Page	193	line 38	*insert after "et"*		isotypus in
	194	25	*insert after "et"*		isotypus in
	203	35	*insert after "et"*		isotypus in
	213	41	*insert after "et"*		isotypus in

ERRATA, VOLUME FORTY-SIX

Page	307	*for*	warkupii	read	*warcupii*
	438	*for*	Suctisporus	read	*Scutisporus*
	444	*for*	Triposperumum	read	*Tripospermum*

PUBLICATION DATE FOR VOLUME 45

MYCOTAXON for October-December 1992, 45: 1-548
was issued on November 2, 1992

[Continued from inside front cover]
Spanish Myxomycetes. VII. (Province of Castellon).
G. Moreno, C. Illana and A. Burguete 407
Vulpicida, a new genus in Parmeliaceae (Lichenized Ascomycetes).
Jan-Eric Mattsson and Ming-Jou Lai 425
The value of dried fungal cultures for taxonomic comparisons using PCR and PFLP analysis. . . . . **B. D. Wingfield and M. J. Wingfield** 429
Water-borne hyphomycetes in Singapore, with a description of an undescribed species of *Trichocladium*. . . . . **Keisuke Tubaki, Teck Koon Tan and Yoshio Ogawa** 437
Morphology of edge lines of chained immature conidia on conidiophores in powdery mildew fungi and their taxonomic significance. . . . . **Hyeon Shin and Yong-joon La** 445
Lecanora navarrensis, a new lichen species from North Spain. . . . . **J. Etayo** 453
Revision of *Schizoparme* (Diaporthales, Melanconidaceae).
Gary J. Samuels, Margaret E. Barr and Rosalind Lowen 459
Book reviews. . . . . **L. M. Kohn** 485
Author INDEX 491
INDEX to fungous and lichen taxa. 494
Reviewers. 508
Errata. 508
Publication Date, MYCOTAXON Volume 45. 508

EDITORS OF MYCOTAXON

JEAN BOISE CARGILL, *Editor-in-Chief*
Harvard University Herbaria
22 Divinity Avenue, Cambridge, MA 02138, USA

ASSOCIATE EDITORS

ROBERT DIRIG	G. L. HENNEBERT	LINDA M. KOHN
Index Editor	*French Language Editor*	*Book Review Editor*
Bailey Hortorium, Mann Library	UCL, Place Croix du Sud 3	Botany Dept., Univ. of Toronto
Cornell Univ., Ithaca, NY 14853	B-1348 Louvain-la-Neuve	Mississauga, Ont. L5L 1C6
USA	Belgium	Canada

MYCOTAXON is a quarterly journal devoted to all phases of mycological and lichenological taxonomy and nomenclature. It seeks to publish all papers within 5 months of submission, using photo-offset lithography. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in French or in English. Summaries in those or in any additional languages desired by the authors are given for longer articles. KEYWORDS are provided for each article to facilitate library and computerized access. Printing is on high quality, acid-free, recycled book paper.

EDITORIAL SERVICES & INFORMATION FOR PROSPECTIVE AUTHORS

Authors prepare their own *camera-ready* copy after having received critical comments from pre-submission reviewers. Detailed *Revised Instructions to Authors* appeared in MYCOTAXON **26**: 497-510 (1986). A copy of these instructions will be sent upon request to the Editor-in-Chief.

Neither *BIOPLATE* transfer letters nor *SPECIAL MANUSCRIPT PAPER* are any longer available, and will not be restocked unless there is a strong demand from our authors.

SUBSCRIPTION INFORMATION

Each volume, beginning with volume 3, contains at least 512 pages, and consists of an *irregular* number of quarterly issues (rarely an *additional* issue, a Festschrift, may also be included in a volume). Each issue of MYCOTAXON varies in number of pages. Subscriptions are normally on a *per volume* basis, but subscribers may choose an *annual* basis to avoid frequent billing. Currently this would involve prepaying three volumes. *Personal subscriptions* are available at a substantially reduced rate for *individuals* who agree not to deposit their copies in another library than their personal one within 3 years of receipt. Address orders to the Mycotaxon Order Department, *not* to the Editors. Prices for the current volume are:

	USA	Canada/Mexico	Other Foreign (Air)
REGULAR (multiuser)	$60.00	$62.00 US	$65.00 US
PERSONAL (individual)	$28.00	$30.00 US	$35.00 US

(*All back volumes are still available.* Volumes 1 through the latest *complete* volume are available at $25.00 per volume when shipped by *surface mail*, $40 per volume by *air mail*.)

Place subscriptions through the Order Dept., MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14851-0264, U.S.A. or through your agent. MYCOTAXON may also be obtained on a journal-exchange basis. This may be arranged with journals, institutions, or individuals who have difficulty in obtaining foreign currency.

TWENTY-VOLUME CUMULATIVE INDICES, 1974-1984, & 1984-1991

MYCOTAXON CUMULATIVE INDEX FOR VOLUMES I-XX (1974-1984) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-00-5) is available at $17.50 *postpaid*, and MYCOTAXON CUMULATIVE INDEX FOR VOLUMES XXI-XL (1984-1991) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-01-3) is available at $30.00 *postpaid*, from MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14851-0264, U.S.A.

AVAILABILITY IN MICROFORM, TEAR SHEET, & PHOTOCOPY

MYCOTAXON is also available in *microfiche* and in *microfilm* from University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A., or 30-32 Mortimer Street, London W1N 7RA, England, from whom prices may be obtained.

Tear sheets or photocopies of individual articles may be obtained through *The Genuine Article*™, I.S.I., 3501 Market Street, Philadelphia, PA 19104, U.S.A., from whom prices may be obtained.

CONTACTING MYCOTAXON'S EDITOR-IN-CHIEF BY E-MAIL OR BY FAX

To reach the Editor-in-Chief regarding manuscripts, you may use this electronic mail INTERNET address: Cargill@HUH.Harvard.Edu. or you may FAX to Jean Cargill at (617) 495-9484.

CONTACTING MYCOTAXON'S ORDER DEPARTMENT BY FAX

To reach the Order Department for information or placing orders, you may FAX to Richard Korf at (607) 273-4357